

Age of phosphate pits, Pierce, Florida

Hemphillian - Lower Pliocene

Same as Capotano Formation

UCMP Capotano Beach

LACM loc. 6906 -- Carpometacarpus no. 36332 No such # for bird could this be 37632 now refers to r. cauc. cf?

Presbychen abavus ?

Type tibia between Canada goose and Whistling swan.

Material so far recorded as P. abavus:

Type -- dist. tibiotarsus USNM 11973 Wetmore 1930 Sharktooth Hill

Referred prox. ulna UCMP 50019, Granite Canyon UCMP loc. V71013 (13?)
= LACM loc. 3230 ~~Exempted 1934~~ Is this the specimen we have a cast of thanks to Morejohn? Unrecorded?

Referred: Prox. tarsometatarsus LACM 16466 Sharktooth Hill
prox. frag. femur LACM 16465 tentative from S.T Hill
HH 1966

Referred: Prox. frag. tarsometatarsus LACM 17552 Loc. 1945
Inc. femur LACM 17553 LACM 1945 HH 1966

Check other casts from Sharktooth Hill provided by Morejohn.

Miller, 1961 records a proximal end of ulna as Branta sp. as being too small to represent Presbychen abavus.

NOTE: If, as seems possible, Presbychen and Chendytes are somehow related, Presbychen would have a small ulna See Cast of Humerus(?) Morejohn contributed.

The specimen now at hand from LACM locality 6906 is an inc. carpo-metacarpus no. 36332.

loc 1557 See also Sharktooth Hill ^{LACM} loc. 1557 cast of prox ulna UCMP 95470
UCMP loc V6323
loc 3230 Granite Canyon 93050 prox humerus cast
loc 3230 (UCMP V71013) (= 50019?)
loc 6688 Sharktooth Hill loc 6688 (= UCMP loc. V6843)
A cast of dist tarsus # 86039 (LACM # 50621)
B cast of dist ulna # 88345 (UCMP loc. V6843)
(our cast # 50620)

Size of carpio. 36332 relative to Canada goose + swan
" " ulna UCMP 50019 (cast) rel. to " " "

Size of type tibia Wetmore 1930 (USNM 11973)
ls condyle 18.6
depth ext. 16.8
" int. 19.0

Gavia brodkubi new species.

Holotype ♂ Left? Complete ulna ^{Pacm} no. 31173
Right

~~Formation~~

Type locality Pacm no. 6906.

Formation & age. Monterey formation, Claarendonian, late Miocene

Description: ^{approx 75% shorter} smaller than Gavia stellata but with
relative stouter. Attachment of anterior articulation
relatively broader proximal and distal.
ligament short and broad (br. 85% of length)

Discussion: ^{the only other Miocene bone} ~~The only other Miocene bone~~ calymenoides mites,
from the Aquitainian of France is also known from a ulna. This is
known from ~~France~~ ^{California}.
Depending on whether the measurement given is thought to
be ~~little more than 50% of that of G. stellata~~ ^{60-65% of that of G. stellata}, the Calif specimen
is ~~the same size as the ulna of G. stellata~~.

Chance of
Calymenoides?

Gavia
Description of the ulna of G. stellata.
is.
Gavilla pusilla Shufeldt purported to be from the
White River Oligocene of Wyoming, is known only
from an incomplete calymenoides. This is
smaller than G. stellata & is described
(Wetmore 1940 p. 28) as being so widely divergent
from Gavia as to be deserving of subfamily
distinction. It is, therefore, this fact coupled with the
its much greater age makes ~~it an unlikely~~ ^{relationship to} G. brodkubi so ~~rather~~ ^{relatively} improbable.

77.5 81.1
50.2 50.2
27.3 20.9

25-36% smaller

Two
6.2
5.8

List of bird bones from Laguna Niguilla sites (Miocene)

sketch

Gavia complete ulna 31173 Loc. 6906

Puffinus complete ulna, nr. comp. humerus 42654m 42652, Loc. 6906
dist. ulna 52748 Loc. 7136
wing phalanx No.? Loc. 3185

Oceanodroma? tarsometatarsus loc. 6902 X
humerus (alcid? 37689? Loc. 6906 = 37486?

Diomedea californica? dista. tibiotarsus 37629, dist. radius 31172 Loc. 6906

Diomedea (smaller) distal tibiotarsus 37674 Loc. 6906

Sulidae tibiotarsus 52217 Loc. 3185

carpometacarpus 37634, 37635 Loc. 6902 X

dist. ulna 37636 Loc. 6902 X

rostrum 37614, femur 37628, tarsometatarsus 32431, 32428 6906

Sulidae very large carpometacarpus 37632, HUMERUS 32420 Loc. 6906

Sulidae? pedal phalanx 31171 Loc. 6906

Femur 37633, jaw fragment 52590 Loc. 6902 X

Osteodontornis lower jaw frag. (several teeth) 22444 Loc. 6902 X

lower jaw frag. (1 tooth) 42656 Loc. 7136

Carpometacarpal shaft 53906 Loc. 6902 X

Alcidae Lunda prox. humerus 42658 Loc. 7136

" dist. humerus 37638 Loc. 6902 X

sp.? prox. humerus 52018 Loc. 6902 X

sp. (tiny, may be Oceanodroma) humerus 37686 Loc. 6906

Praemancalla? two humeri, prox. ulna 42653, 32432, 32427 LOC. 6906

CORACOID, RADIUS 37637 and 43907 Loc. 6902 X

carpometacarpus 52216, Loc. 3185

?, Goose? Carpometacarpus 36332 Loc. 6906

= 37432?

Carlo Anciller
(egg paleont. from Mexico)

Quadriformis

Check attach ant. ant. of
on lunaticus vs vela
in stellata; pacificus in
vs. 31173 + type lunaticus

OR

Gavia howardae -- referred

G/ Brodkorbi -- Holotype: Left (✓) complete ulna LACM 31173 collected by _____ in _____ (date).

Formation and Age: Monterey Formation, Calrendonian, Late Miocene.

Type Locality: LACM no. 6906

Description: Approximately 2⁵/₈ mm shorter than the ^{average of four} ulna of *Gavia stellata*, but relatively stouter (see table). Attachment of anterior articular ligament short and broad (breadth of attachment approximately 85 per cent of its length), in contrast to longer, narrower attachment in *Gavia stellata*, *G. pacifica* and *G. immer*.

Discussion: Although loons are well represented in the Pliocene earlier Tertiary records are limited to *Gaviella pusilla* (Shufeldt) from the White River Oligocene of Wyoming, *Colymboides minutus* Milne-Edwards from the Lower Miocene (Aquitania) of France and *C. anglicus* Lydekker from the Late Eocene of England. Both *Colymboides* and *Gaviella* are sufficiently distinct from modern loons to warrant subfamily distinction. *Colymboides minutus* is represented by an ulna that is at least 27 mm shorter than the ulna from Laguna Niguel.

The Pliocene loons include *Gavia concinna* Wetmore, *Gavia howardae* Brodkorb and *Gavia paleodytes* Wetmore. *G. concinna* and *G. howardae* were described from California, with *G. concinna* also reported from Florida (Brodkorb 1953). *G. howardae* is known only from California. (1943)

Wetmore/records the type coracoid of G. palaeodytes as being "The smallest member of its family, either living or fossil, at present known," Brodkorb (1953), who has assigned a second coracoid, distal humerus and complete femur to the species finds the coracoid to be similar in size to that of G. stellata, the humerus to be larger than that species and the femur to be longer and narrower than in either G. stellata or G. pacifica. G. howardae was described from the type humerus and two referred humeri, all distal ends. All are smaller than in G. stellata, and might, therefore, correspond in size to G. brodkorbi. Miller (1956) and Miller and Bowman (1958) have assigned incomplete tibiotarsi to G. howardae. No measurement was given in 1956, but the specimen was ~~said to have a total length of~~^{thought to have a "total length"} ~~xxxxxxx~~ ~~xxxxxxx~~slightly less than males of G. stella^{ta}, but the bone is stockier." The 1958 record, a distal end was said to be narrower than in G. stellata, but no measurement was given. 11.3 (within range of stellata)

n. 11.3 (within range of *stictatus*)
lay between above
11.1 and *stictatus* OVER

65120, juv. tarsus 32 363 size of 9, pacifi
 with br.
 reddish brown

SEE LOCALITY 65121: proximal ulna 31618 (smaller than stellata)
 (also in 65121 a distal humerus 31630 (br. dist. 11.0)
 and coracoid 31617). And dist. tibia 31631 br. dist. 12, Bassanus 13)

SEE LOCALITY Mission Viejo 1975 collection "Case VIII"? Loc. 3891?
 includes proximal ulna, radii, femur and others

EXAMINE TYPE OF *G. concinna* -- cast in Type collection

check dimensions of attachment of ant. art. lig.

MEASURE tibiotarsus 2314 from San Diego recorded by Miller and Bowman.

San Mateo from V.C.M.P. tarsus 88 656 prox (size of pacifica)

Measurements of fossil and modern loons:

	31173	stellata	<i>G. concinna</i>	<i>G. howardae</i>	<i>G. palaeody</i>
Ulna					
Length	81.1	106-108			
prox. br.	9.4	10.0-10.3	11.7 (Wetmore 1940)		
shaft br. middle	4.89	4.8 - 4.95	5.8 6.7 (H. meas. on cast)		
shaft dep.	5.6	5.5 - 6.0	7.2		
ratio prox to length	11.6	9.4 - 9.5			
ratio sh. br. to length	6.0	4.8 - 4.9			
Humerus					
Dist. br.		10.3-10.7	15.5-16.7 (Wetmore 1940)	12.0-14.0 (H. meas. on cast)	14.3 (H. meas. on cast)
shaft dep.		5.0 - 5.2	5.8 - 6.7	4.6 - 5.1	5.1 - 5.7
dist. dep. (int.)		9.1 - 9.5		8.8 - 9.2	9.1
incomp. length		106.4-112		91.1	
ratio dist to inc leng		9.5 - 9.7		10.0-10.6	
ratio sh. dpt to inc. leng		4.7 - 5.1		5.0-5.5	

check these figures

Breadth ant. art. lig. 4.0 3.0-3.1 4.8
 4.7 4.4-10.0 8.8
 Ratio to hum. 85% 31-32% 55%

Distal end, carpal tubercle, short prox. distal end and jutting abruptly from shaft as in

a pair of *pacifica* as distinguished from *G. stellata*

107 113.9 106
 106 123.4 81
 109 237.3 20
 106 18.4
 438.5 81.1
 107.4 37.3
 81.1
 26.4 = 24% less

hum. stellata to basal troch
 110.3 106.8
 91.7 91.7
 15.1
 43.74
 109.4
 91.7
 17.7 16%

Ulna	G. brodkorbi	G. howardae	G. stellata
Length $\times$	81.1	#2133 Type	107.4 106.2-109.7
Breadth proximal cotylae	9.4 8.6		10.2M 9.9-10.6
Ratio br. dist. to hum.	52.490		43.4-46.540
Breadth shaft middle	4.5		4.4-4.5M 4.4-4.8
Greatest breadth distal end to tip of carpal tuberosity	10.8		11.2 11.0-11.4
Depth through external side distal trochlea	7.5		7.9 7.7-8.3
Ratio br. shaft to length	16.6		40.8-43.420
Humerus			41.7 43.0 42.4
Breadth distal condyles		9.6-10.4*	10.4M 10.3-10.6
Breadth shaft above brachial impression		6.8*	6.9 6.4-7.3
Ratio br. dist. to dist. condyles		64.690	62.590-69.590
Length from distal condyles to distal tip margin bicipital crest		91.7	109.3M 106.8-110.8 (aver. 109.3)
Ratio length fossil hum. to length G. stellata		84.7%	
Length fossil ulna to G. stellata		75.5%	
Breadth fossil ulna (prox. to stellata)		84.4	
fossil hum to " dist.		86.7	92x 97.2
Br. fossil ulnae prox. to humerus distal using type howardae hum. and type brodkorbi ulna		82.7	
sugin 2133 howardae hum and type brodkorbi		89.5	
Ratio br. hum. dist. to humerus		99.20	92.133-92.20
Ratio br. hum. prox. brodkorbi to stellata		92.13	

See Loc 45/21 Gavia dist hum, 31630 11.0 br.
See mentioned prox ulna also
Order Gaviiformes
Family Gaviidae

Gavia brodkorbi new species

Holotype: Left complete ulna, LACM 31173, collected by Marion J. Bohrer, 1969.

Formation and age: Monterey Formation, Clarendonian, Late Miocene.

Type Locality: LACM 6906

Diagnosis: 25 mm shorter (23.6%) than the minimum of four specimens of Recent Gavia stellata, but relatively stouter. Proximally, attachment for anterior articular ligament ^{short & broad & prominent} prominent, but ^{with back impression deeply running its distal half} shorter and broader than in the living species (breadth of attachment 85 % of its proximodistal dimension). External cotyla ^{bevel toward shaft} short in distal extent, with short scar running mediad directly beneath. Distally, carpal tuberosity jutting abruptly from shaft [as in G. pacifica].

Measurements and proportions: Greatest length 81.1 mm, breadth across proximal cotylae 9.4 mm, breadth of shaft at middle 4.5 mm, greatest breadth distal end (through carpal tuberosity) 11.3 mm, depth distal end through external crest of trochlea 7.5 mm, ratio breadth proximal end to length 11.5% (G. stellata 9.3-9.6%), ratio breadth middle of shaft to length 5.5% (G. stellata 4.1-4.4%), ratio depth distal end through external crest of trochlea to length 9.2% (G. stellata 7.2-7.8%). Length back, 15.8 br. 2mm 3.8 (shank 19.5x 3.6) 24x 3.5

Discussion: The only previous Miocene record of the genus Gavia was based on a poorly preserved tibiotarsus from the Calvert Formation in Maryland, cited by Wetmore (1941:567) as Gavia sp. Four species have been described from the Pliocene:

Gavia portisi (Regalia) -- Middle Pliocene, Italy

Gavia concinna Wetmore -- Early ~~and Middle Pliocene~~ ^{Pliocene, Florida, Middle} Pliocene, California

Gavia palaeodytes Wetmore -- Early Pliocene, Florida

Gavia ^{howardi} brodkorbi -- Late Pliocene, -- California

According to Brodkorb (1953), who reviewed these species, Gavia portisi is known only from a cervical vertebra that is nearly as

large as that of G. immer. The type of G. concinna ~~Wetmore~~ is an ulna, much larger than that of G. brodkorbi (proximal breadth 11.6 mm), and is further distinguished by a longer attachment for the anterior articular ligament. G. palaeodytes is known from the coracoid, humerus femur, all equal to or slightly larger than G. stellata.

Gavia howardae was described from an incomplete humerus with two additional humeral specimens referred. These specimens ^(all LACM) are at hand. The smallest referred specimen provides a measurement of length from distal end to distal tip of deltoid crest of 91 mm which is 14% less than the minimum for this same measurement in G. stellata. The type is incomplete, but appears to have been longer (possibly within 7 mm of the minimum for G. stellata). Relative breadth is difficult to determine in these incomplete specimens. They appear, however, to be of less stocky proportions than the ulna of G. brodkorbi. Qualitatively there is little on which to base comparison of ^{the} humerus of G. howardi and ^{the} ulna of G. brodkorbi. However, the long, narrow attachment for the anterior articular ligament on the humerus of G. howardae closely resembles the condition found in G. stellata and in no way suggests the unusually broad, short attachment for this ligament on the ulna of G. brodkorbi.

References for Lit. Cited:

- Wetmore, Alexander, 1941. An unknown loon from the Miocene fossil beds of Maryland. Auk 58:567.
- Brodkorb, Pierce, 1953. A review of the Pliocene loons. Condor 55(4):211-214, fig. 1.

card
made

card
made

Gavia howardae was described from an incomplete humerus, with two additional humeral specimens referred. These specimens are at hand. The type falls within the size range of G. stellata in distal breadth.

References for G. howardae:
Alexander, 1961. An unknown loon from the Wisconsin fossil
beds of Caryland. Am. Mus. Nov. 58:267.
Friedhoff, 1953. A review of the Holarctic loons. London
52(4):211-214, pl. 1.

31173 complete ulna
Gavia n. sp. from locality 6906 Laguna Miguel

[Notes: of Gavia specimens from Phocine of Mission Viejo 3891

There is one white tarsus (dubio) smaller than stellata

stellata 1020 - br. dist 11.3; fossie 8.5. Other ^{loc} 3891 loons too large for
and possibly even concinna. ^{measured 6906}

31173 788 1020 28 304 141 794 305
6055w q. stellata s. stellata q. a. pacific q. imma q. concinna q. pacific

Gr. length A	81.0	106.4	109.8	112.9	112.7	141.1	—	123.4
br. prox B	9.4	10.0 ^{9.9%}	10.5 ^{9.4%}	11.2 ^{9.9%}	11.1 ^{9.8%}	12.8 ^{9.0%}	11.6	11.4
br. sh mid. C	4.9 ^{6.0%}	4.8 ^{4.5%}	5.1 ^{4.6%}	5.3 ^{4.7%}	5.9 ^{5.2%}	6.3 ^{4.6%}	6.7	5.7
gr. sh near D	6.1	6.6	6.8	7.3	8.0	8.8	—	—
depth m. chitens	—	—	—	—	—	—	—	—
gr. meas diag E	11.2	11.8	11.8	14.0 ^{23%}	14.7	16.3	—	15.9
dist end ^{might be before} fresh ^{occurs}	—	—	—	—	—	—	—	—
depth ext cond. F	7.3	8.3 ^{28.0%}	8.3 ^{7.6%}	9.3 ^{22%}	9.4	11.0	—	10.7
H ¹ length } ant.	4.7 ^{4.3%}	4.4	10	8.0	7.5	11.7	8.5	—
H ² br } ant.	4.0 ^{4.6%}	3.0 ^{3.1%}	3.1	3.9 ^{4.1%}	4.9 ^{6.5%}	5.1 ^{4.3%}	4.8 ^{5.6%}	—

Gr. length
hachet wip.
dist. from
int. corolla to
to dist. end

I Depth prox	8.8	9.2	10.0	11.5 ^{11.5%}	10.9	12.7	11.8
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J Depth prox from south corolla	8.4	8.7	9.2	10.9	10.5	12.0	11.5
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Ratios ^{BA prox to dist} 11.6% 9.4% 9.57 9.94 9.85 9.06 —

BA ^{prox to dist} 11.6% 9.4% 9.57 9.94 9.85 9.06 —

J B ^{depth to} 89.5% 87.0% 86.7 97.5 94.5 93.9 99.3

C A ^{depth to} 6.0 4.6 4.6 4.7 5.2 4.4 —

X H ¹ H ² H ³	—	6.1	6.7	7.3	7.4	8.4	—
br Jaurachi	—	3.0	3.2	3.0	3.3	3.8	—

H²/H¹ [★] 85% 32% 81 48.7 65.3 43.5 55.4

GA ^{hachet wip. to} 25.6% 25.3 24.7 25.7 26.75 23.9 —

X²/X¹ — 49.4 77.7 41.1 44.7 45.3 —

H¹ X H² sq. mm [★] 18.5 ^{38%} 28.2 31.0 31.2 36.7 59.4 40.8 sq. mm

FE [★] 65.1 70.2 70.5 66.4 64.0 67.5

FA [★] 90.0 78.0 75.7 82.5 83.8 78.0

depth dist. to

Colymboides minutus Mid. Lance

M-E gives length of ulna 0,0502 (= 50.2 mm probably to articulation not olecranon)

Same meas. in #31173 from loc 6906 = 77.5
 g. length 81.1, br. max 9.4, br x depth sh. 4.6 x 5.6, g. dist 10.8
 depth dist 7.2 13.0 length brachia imp.
 g. stellata #788 = g. length 106.35, br. max 10.9, br x depth sh. 4.6 x 5.8
 depth dist 8.5 g. dist 11.4
 Brach. imp 22.0

g. stellata 328 g. length 107.8, br. max 10.3, br x depth sh. 4.9 x 6.0
 brach. imp 22.4 g. dist 11.6 depth dist 8.3

g. stellata 327 g. length 106.6, br. max 10.1, br x depth sh. 4.5 x 5.5
 21.1 brach. imp g. dist 11.4 depth dist 7.6

check attach
 ant. art. lig
 of humerus

Castach. ant. art. lig

Scar on ~~ant~~ int. side below int. condyle is short & broad, not
 long & narrow as in *Gavia* 4.4 br. #328 #327 #327
 3.7 5.0 2.9
 10.7 10.3 8.3
Gaviella pusilla caprimeta (Lac.) x 01:50 Wyo. ^{upper River}
Colymboides anglicus Cope - Coracoid
 " *minutus* *minutus* humus, blue, femur

Gavia concinna - Ples - prox ulna approaches inner in size (but smaller)
 " *parisi* " - vert. size? has claws of all 3 medium mrs.
 " *howardae* " - humerus slightly smaller than stellata. Related to Pacific
 " *pallodytes* " - Coracoid larger than stellata, smaller than concinna but related in claws.

#31173 is between *Colymboides minutus* & *G. stellata* in size 96% of stellata = almost 1/4 smaller; 155% larger than *C. minutus* = 1 1/2 x larger

Gaviella pusilla - Wetmore says "height 8.9 mm." I assume this is the meas. from trachea through process of M1

This measurement in *G. stellata* is _____

Gr. of trach. *Gaviella pusilla* - 4.1 mm. *G. stellata* _____

See Shufeldt 1915 p 70 & pl. 13 fig. 104

Humerus

Ratio length
(dist end to dist
tip of deltoid)

~~smaller~~ howardae to stellata
ann (#2133)

82.3%

Ratio br. dist (gr.)

howardae to stellata av
type

99.9%

howardae aver. to stellata
aver.

95.9%

smaller howardae to
stellata av. 89.2%

100.2%

Ratio br. shaft " "

Ratio br. dist condyles

howardae type to av stellata 100.2%

" min. " " " 92.3%

" aver. " " " 93.5%

Ulna

Ratio length fossil
to aver. stellata

75.6%

Ratio br. condyles to
av stellata

92.2%

Ratio br. shaft to
av stellata

100%

Ratio ht carpal tub
to av stellata

84.2%

Ratio ht carpal tub
to length ulna stellata

61.6

same paripula

46.7

same #31173

47.7

Ratio br dist gr 31173

99.5

to av. stellata

95.5

ext depth dir - 31173 to stellata

Ratio ht carpal tub. to br. dist
stellata 31173 49.0
57.2%
56.8

Ulna br to humerus br
min dist

stellata → 98.2%

31173 / howardae type 90.3

31173 / " 2133 97.8

Tibia San Diego
to stellata

102.2%

Tibia Mission Viejo

br dist to stellata av. 77.2%

ulna #31618
prox condyles to stellata

85.3

br sh to stellata

100.4%

humerus from 65721 31630

dist br. to stellata av. 104.2%

br condyles to " " 105.4%

Gaviller depth

carpo. prox. to stellata 132.2%

" " " " 46.7%

	Pacific	Pachia	305	300	673
h. cond.	28	30.4	30.5	30.0	67.3
mm/may. h.	11.7	11.8	12.4	10.9	10.9
diag. dist.	5.9/7.7	5.9/7.7	6.4/7.9	5.0/6.3	5.0/6.3
	15.3	14.8	15.0	13.4	13.4
ulna					
br. sh. m.d.	5.9		5.7		4.5
par. ext. p.	11.0		11.6	9.3	9.9 (8.490)
gr. l. p.	112.9		123.4		111.8
depth	11.1		11.0		9.4
h. dist.	9.2		10.4		8.0
h. p. dist.	14.2		15.9		12.7
Tibia					
h. dist.	11.2	11.0	12.0	10.6	11.3
depth	11.4	11.1	12.5	11.2	11.0
dist.					
h. dist.	10.3		10.6	9.6	9.1

Stellata has long narrow attach. ant. ant. lig.
both humeri + ulna, Proximal in Pacific ulna
but not humeri

Prox. 31173 ulna much scar
below ext. angle curves abruptly medially
T. corolla is dent in dist. ext. hum.
Pacific scar descends dist. ~~abruptly~~
+ only gradually medially if at all
one spec. of stellata is like fossil but
more pithed

Tarsus has 12 papillae for secondaries
10 ext. show clearly, 2 are prox. & then
show clearly. Other accessories not so
clear. Same as in fossil
Pac. + stellata 13?

Ulna of concinna like pac in
shape + size of attach. ant.
ant. lig. Minor length + narrower
concinna below ext. angle not
curves medially as in 31173 but less
abruptly

07.1	108	110.3
106.5	103	106.8
109.7	110	110.8
101.2	106	109.5
4) 4245	4) 427	4) 4374
106.5	107	109.3
81.1		91.7
25.4		17.6

4.8
4.7

109
99
10

~~91.7 81.1~~

17.6
8
9.6

Laos

109.7
1129) 11000
10141
83.08.4
118.) 990
944
460

293
125.4) 11000
1106
4940

41) 490
486
40

Gavia -

Check tibiotarsal measurements & chars.
pacifica vs stellata
re: referred tibiotarsus distr. ref. by Miller Bon

Puffinus -

Check source of smallest specimen
Is it truly stellata. Check all
chars. to other specimens

- ① brachial impression
- ② ridge on shaft just ly
- ③ auroral protrusion of condyle

Brachial impression less deep than californi & less distally extended ^{h₁} 3.26 x 2.4 ^{depth}
Shaft less flattened, but broadest below not cond.
Californi 2.9 x 4.5
Vanoli 2.6 x 3.8
Puffinus 2.9 x 5.0
Mitchelli 3.4 x 4.7
Opertus 2.2 x 3.8
Galapagos obscurus 2.5 x 2.3
Puffinus edge int. condyle smaller, in contract ^{to 2.7} on int side with depth above h₁ obscure
P. californi - Bladder
Small papilla on dist edge of int condyle
int to obscure

Attach ant. ant leg. turned slightly laterally (int, side)
rather than directly palmar (also P. pacificus)

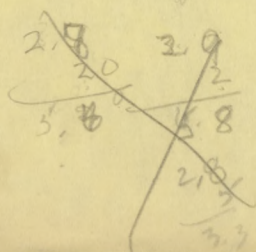
Puffinus also has swollen int. condyle & papilla
tho not as swollen in pacificus 2.4 [1.7 isobrevus)

Much thinner than fulthamii
more rounded shaft

2.6	6%
2.8	mitcheilli
2.5	vanoli
3.6	conradi
2.3	pacificus 18140
2.2	opertus 553
2.3	fulthamii
2.7	fossit 6906
2.0	californi

$$60 = 1.75$$

$$40$$



Puffins

Miguel

N. Amer. Puffinus figs = tarsus

Large

1.90 cuneatus (subgenus Thyellodroma)
1.90 Kuhl's fuliginosus 2.25
2.20 borealis giseus 2.00
2.40 gravis
2.10 creatopus

Medium

1.80 puffinus

Small

1.60 (Audubon's) tenuirostris 1.90
1.80 obscurus? capensis 1.62 (4 mm)
1.80 Opisthomerus Pacific Ocean San Francisco
1.80 auriculatus - very small
1.35 assimilis (Australia, NZ) & 1.0 Atlantic

egg of Mex. N. Hand 11-12 long, egg 52.5 x 36.2 mm

Audubon's

egg 2.05 x 1.45 inches

obscurus

egg 57 x 40 mm

auricularis resembles

egg 60.9 x 41.2 mm

Opisthomerus

giseus © Bent

tenuirostris resembles

cuneatus

Thyellodroma pacifica

bulleis - N.E.

egg of Mex. New is Japan

11-12 long

large 50 ocean

Circus cinereus

Check source of smallest

Opisthomerus specimens

check chars. carefully.

to other specimens,

Aramidap cont'd

Badistornis aramus (Oligo. & Dak.).

Check distal ulna
of Puffins from
loc 7136

LACM 52748

There are six mty Puffins
labeled for Calif. today (Gunnell &
Miller 1944). There may have been
an equal # in Misau & Rhin

Puffins sp known today in Calif
P. creatopus
P. carolinensis (monachus)
P. bulleri " with other sps.
P. griseus
P. tenuirostris (with Sooty)
P. puffinus

1625 { dist hum 16909 P. purus (recalc)
 { humeri mit chelli? 17503
1655 { 1 ulna sp. 17505, circ. 17506

X ✓ dist ulna 18497 P. pur. sp.

1557 - P. inceptus 6972 prox humeri

6688 - P. purus? humeri 18140

X " " " " ulna 174502, 0304

Case VI 12, 13, 15

Case VII - 11?

6906

humeri 376867 - try scandioma?
ulna 42658 - Puffinus see humeri
42652 ←

Puffinus

Check to diatomaceous

Puffinus new sp.?

Material: Humerus with incomplete proximal end LACM 42652 (Loc. 6906)
(length from distal end to dist. tip of deltoid ~~67.4 mm~~
67.4 mm; same distance in Sharktooth Hill humerus
which is probably P. priscus, 64.4 mm. *P. bellhemi* 71.2, Telpuquet 65.
Further distinguished from P. priscus by less flattened
shaft (less dimension in depth) ratio breadth to depth
of shaft above distal end 52.5% in priscus, 60.4% Loc. 6906
Brachial impression less depressed also narrower in
proximo-distal dimension than in P. priscus

Ulna no. 42654 complete

less distally extended
Humerus 42652 distinguished from P. calhouni (of Loc. 1945)
Broader, rounder, more shallow brachial depression
More swollen anconal edge of internal condyle (this area
notably flatter in calhouni --even flatter than opisthome
Ant. art. lig. attach faces slightly more laterally but
less laterally than in priscus
Small pit flanked by a ridge external and below attachment
ant. art. lig (none in calhouni)--more like P. kanakoffi
or priscus in this character. The angle of the attachment
for ant. art. lig. also resembles kanakoffi
Shaft less blade-like.

Humerus distinguished from P. kanakoffi
Broader, rounder brachial impression
Shaft less bladelike

Webster 1938 records P. U.S. Nat. Mus. 85, 22)
Puffinus sp. humerus. L. to dist. 14.9 mm.
br. sh. mid. 6.7 mm. Calvaria formation

Oceanodroma?

Loc 6902 - tarsometatarsus 42659

[also check humerus 37686, ^{Loc 6906} which, however,
may be alid.]

Tarsal length in O. hubbsi 22.4 mm

810 11.5
940
810
1300
810
4800
3244
5440

811 11.5
940
811
1490
811
4790
1053
1113

811 11.5
940
81
130
81
490
405

Puffinus

Casts of	fine specimens of P. diat. from Lampyris	bone	price
	raised type noches	plate 7A	specimen
Length humerus + torus	79.8	77.1	78.2
Length humerus to deltoid	61.3	59.8	60.1
Br. dist. cond.	6.8	—	—
Ht. from dist. end to proximal edge of ectepi.	11.4	—	9.9?
" " base of "	11.9	—	—
dist. end to top of brachial impression	8.7	9.9	—
Depth shaft above ectepi. process	7.2	4.35	6.3
Depth middle	6.2	5.65	—
Length ulna distyle	74.1	69.2	69.7
Depth ext. trachel.	5.5	—	—
Length capsa.	—	41.3	42.8?
" " coracoid	27.5	—	—
Ratio ht. ectepi. to length to deltoid	18.9%	—	16.4%
" " br. dist. cond.	173%	—	—

- P. conradi - very much broader
P. mit chelk - longer more beel on shaft
P. felthamii - length 70.4 to deltoid, sh. 3.5 x 6.9, br. dist 8.35
6906 is almost as long but slimmer (6906, 60%)
P. banabuzzi - length 64.1 to deltoid, dist br 7.2, 3.0 x 5.5 sh., 9.2 ht. ectepi.
3.4 x 4.4 mid sh. (62.8%)
P. calhorni - br. dist 7.0, depth ext 8.0
3.0 x 5.9 sh. same dist. end (50.8%)
P. piscus - br. dist sh. near dist. end 3.45 x 6.2 (53%) (quinta #553)
3.2 x 5.7 = 56.2%

Hummer # 42652 from 8026906 N

Puffinus
Differs from type of Calhouni

Broader, rounder, more shallow basical depression

More swollen auroral edge of ant. condyle

(in Calhouni this area is notable flattened even
than prothomelas)

Ant. ant. lig. attach. faces slightly more laterally

than in Calhouni but less so than in praeus

Small pit flanked by ridge ant. & below ant. lig. attach.

(none in Calhouni) more like Kanakoffi or

praeus in this. The angle of the ant. lig. attach.

also resembles Kanakoffi

Shaft less blade like

Differs from Kanakoffi

Broader, rounder basical, upper

Shaft less blade like 3.5 x 5.8 (above dist.) 26.0 or 61.5

30 x 5.6 Kanakoffi (27.0) 55.0

26 x 5.4 " 21.6 46.0

32 x 6.1 " 21.6 52.4

3.1 x 5.3 = 58.5% P. guillemoti, Lutz

29 x 5.7 Calhouni type 51.0

33 x 6.2 Cast praeus type 53.3%

32 x 5.9 opith. 54.3 54.4

30 x 5.5 " 55.3 56.5

33 x 5.9 Calhouni 15529 56.0

3.8 x 6.9 refined Lutz type 55.0

4.6 x 6.3 creatura 53.0

3.7 x 5.4 pacific 52.0

2.9 x 7.3 guineus 53.5

Hummer

Pr. dist. end 7.8

eye depth 8.5

ant. " 6.6

1st edge praeus 9.5

above Lutz

from end distal 66.9

(Lutz 8.5,

praeus 83.6-88.0; Lutz 71.2)

praeus 59.7

Puffinus

Scotts Valley (Marjorie)
P. californicus
M. longicauda
S. willardi?

M. willardi?

hamus?
 1945
 17547

type
californicus

type
willardi

	42654 42654	1945 17530	1945 17538	1945 17547	
Be proximal	6.4	6.5	6.8	4.6 x 5.4	
to, sh. depth	4.8 x 5.1	4.7 x 5.2	1945	1945	
Be dist. humus	4.2 x 5.2		17548	17539	<i>californicus</i>
	7.8		2.4	7.1	
dist to edge					
on prox. fur, etc	9.3				
with depth dist	8.5				
ext. dist	6.4				
shaft	6.2 x 3.8				
			36 x 5.9	3.4 x 6.1	3.6 x 5.3
				3.4 x 6.1	

hamus?
 3.4 x 6.1

42654 ulna fur

resembles *pusius* from 1945 in more prominent leg dist. ul of attach of ant. art. lig.
 which terminates higher on shaft than *californicus* papilla at
 base of leg of ext. condyle (but less from than in 1945
 17547)

hamus 42652 resembles *pusius* distally in rod of attach of ant. art. lig. laterally
 distinct from *pusius*, however in that brachial v. uln. does not go as far ectepi. proc.
 and is broader at top. Also distinct from *hamus* in position of brachial v. uln. low as in *californicus* but broader at top
 + rel. to depth shaft greater

Puffinus

Laguna Hills (or 6906-N
(Las. Miguel) Antinetes

Humerus 42652 lacking only extreme

	prior end	Type P. kanabiffi	Type Calhouni	Cent type Puffinus	Puffinus #553
gr. (diagonal) br. dist end	10.7	10.7	10.45	10.7	10.7
br. dist condyles	7.7	7.1	7.1	7.2	7.2
dist. from dist end to top of	9.5	9.0	9.25	9.4	9.4
scapular process	8.3	8.2	7.9	—	8.5
Depth anterior condyle	3.55 x 5.9	3.0 x 5.6	3.0 x 6.0	3.45 x 6.2	3.2 x 5.7
br. x depth shaft	3.55 x 5.9	3.3 x 1.6	5.90	5.55 x 9.0	3.2 x 5.7
near distal end	3.3	3.5	4.25	3.0	—
ht brach. vnt. s.	4.0	4.7	4.5	4.7	—
gr. br. (diag. "	—	—	—	—	66.9
Length from dist condyle to dist tip deltoide crest	62.9	65.0	—	—	—
dist lig. attachment	3.6 x 2.0	3.3 x 1.6	3.85 - 1.7	3.1 x 1.9	—
Depth of ulna at 42654	71.1	—	—	—	93.9
Distinguished from Kanabiffi	—	—	—	—	130.5
Higher scapular process	123.4	—	—	—	—
More transverse (less diagonal)	—	—	—	—	—
Brachial impression which is also narrower in vertical dimension	—	—	—	—	—

Shaft not quite so flattened

Distinguished from Calhouni
Less deep + narrower (vertically)
brach. impression
Less flattened shaft

Generally larger
Small pit beside lig. attach
is lacking in Calhouni
+ lig. attach is narrower

Brach. vnt. is much
deeper in Calhouni
+ rounder

Wgt 42652 over 8 mm this is complete (br 93)
Wgt 42654 71.2

P dist humer 77.8 77.0 81.1
ulna 71.4 69.8 76.3

136.1 Kanabiffi cond
small depression adjacent to
int. lig. attachment more near
base of "

Dist. from process
small depression adj. &
int. lig. attach, is less developed
than in previous (in previous it
is large + extends from base
to more than half way up
lig. attach. occurrence
short + broad in previous
shaft dimensions more
like previous than others sp.
close to previous in all
chars. except narrower
brach. vnt. + less deep
(quite round in previous
+ extends above level
of base of scapular process)
nor so in the new fossil
from 6906-N

Ulna is
relatively shorter
(to humerus) than
in modern species.
but shorter shaft
humerus has
deeper brach. vnt.
than modern
also.
pit beside lig. attach
is more centrally
located than in modern
spec. species. +
lig. attach narrower
in position

PUFFINUS

Diomedea californica
 Dist tibia # 37629 from loc 6906-
 br. to surface of ext condyle (edge broken) 19.8 - exulans 20.2 albatrus 16.3
 br across at level of bridge 15.8 " 17.7 13.6
 br shaft 10.3 " 9.8 9.3
 Depth intercondylar area (thru body) 11.5 " 13.3 10.1
 Dist shaft 7.7 " 8.1 6.2
 Check loc 6906 dist humerus 32430 for Megapalaeolodus vs Diomedea or mouse
 Miller describes D. calif. as larger & stouter than D. albatrus
 "equal in shaft diameter but narrower across tubular than
 adult of D. exulans."
 The tibiotarsus 37629 from loc 6906 is also stout in shaft
 but smaller in other dimensions than exulans.

Large Sulids
 6906-32431 tarsus (34) dist br. 17.5 sh. b. ^{above} foram 1st, basenun 8.6 m. basenun 17.5
 6906 37628 dist femur ^{med. dist} sh. b. 10.2 " 8.5
 med. " 9.0 " 7.2
 6906 32430 dist humerus br 25.9 " 22.2
 Sulidae gr. br. 29.3 " 24.0
 layer than basenun
 6906 37632 capro. length 116.0 sh. ? " 90.0 ^{Polarisator} 102 mm
 Sulidae
 6902 37634 capro " 94.8 longegus
 6902 37636 dist ulna br. condyles 10.6 longegus " 10.1
 br through process 16.6 " 16.2
 gr. sh dimension 9.9 " 9.3
 6906 32431 tarsus br 18.1 (basenun 17.6)
 dist sh br 10.4 " 9.3
 length to hypotarsus 46.8 35.3

Measurements		UCLA UCLA		Type	LACM	LACM	649			
		"B"			cont 694	cont 694	693			
moder	Hummer	Tepusquet								
out	72.3	94.7	head to tip of culmen depth	78.6 mm	71.4	69.4	47.1	68.8	73.2	7.6
81.5	101.4	Length	87.8	75.2	84.4	80.6	77.4	80.7	80.0	
9.0	12.1	1st culmen from dist.	9.5	9.4	11.6	10.3	10.6	8.6		
73.5	110.0	ulna length	85.0	71.4	76.5	74.6	76.1	72.5	77.5	
44.0	56.0	carpal	46.2	40.6	43.4	—	41.5	43.1	45.2	
20.5	25.6	1st wing phal.	21.7	19.1	19.7	—	18.6	20.7	19.1	
		Ratio hum/ulna	103.2%	103.7%	108.9%	108.7%	100%	106.2%		
		" carpal/ulna	52.6	54.4	53.7	53.8	56.4			
		" phal/phal	47.0	48.4	44.9	48.1	42.5			
		" carpal/ulna	54.4	56.4	58.3	59%	58			

See Chukotka Hill

unmeasured 1625 (1 humerus 17500 Mitchell)
 new - 1 nearly complete 44658 length 51 mm, process

1625 dist humerus 16469 assigned to pinus

44688 brown " 18140 prox to 15.2 process
 humerus 174502 " 15.4 process

Mitchell		comb. with		pinus		pinus	
17500		length 98.3		44658		18140 17502	
		my tarsal	87.1	—	79.9	81.6	—
		dist. "	11.6	11.4	70.4	71.6	—
		to dist cond.	8.9	9.6	96.3	10.0	—
		q. prox br.	12.6	—	7.4	7.6	7.4
		depth sh	6.3	6.5	—	14.9	15.4
		br "	4.6	4.3	6.5	6.1	6.5
					3.5	3.6	3.3

Check Puffinus humerus from
 Loc 6904 with
 Tepusquet

864? humerus possibly right wing
 71.8 ulna too small

75.5
 11.4
 86.9

Fossil Paffius rounded

Oligocene - Belgium dit humerus (Brookhuis 1962, auth. p. 207)
[Larus] designates humerus as type
P. saemondseni (van Beneden)

Low. Mid. - ~~ME~~ ME

P. arvernensis Faurus 42 mm length

France

7.2 " prox

3.3 " 8th mid

7.4 " dist

3.5 " depth to ext mid

[*P. diatomus* Faurus length
48 - 54.6; depth 45]

smaller than 6906
specimen
(7.7)
1 *P. micraulax* Brookhuis human dist Florida
5.4 dist condyles
[dist. ? 8.2 mm to ?]
[depth 7.0 - 7.5]

Mid. Mid.

P. aquitanicus ME dit hum. France
length 108 mm ?

P. autigenus ME prox hum. France larger than *capensis*

2 Large *P. conradi* Mark Maryland dit humerus Maryland
hum. larger than 6906
dist br. 13.4 girth condyle ? size = *P. cinereus*
depth 7.7 cond. See Shufeldt 1915 p. 62.
Mober 1926 auth. p. 463

3 g? br. 12.2 *P. inceptor* Wetmore dit humerus - Chautauque Hill

4 cond br. 7.3-7.4 *P. piceus* Miller " " " " larger than *piceus*

5 cond br. 8.6 *P. mitchell* " " " "

6 " " 6.8 mm *P. diatomus* " *impressus* Linton

7 lat. mid. *P. californicus* dit humerus - Herbert World

Pliocene

8 hum. dist br. 7.3-8.0 *P. barakoffi* Howard dit humerus San Diego

9 " " 8.5 *P. feltham* " " " " Corona del Mar

10 *P. tadfordi* " tarsometatars. Baja Calif heavier than *specimen* but length about same.

Mid 6906

hum. br. dist 7.7

X Length ulna 68.3-76.3
Y Br. hum 65-69

70.3
6.54

6.5

Crater 6.6

Humerus
90.0

specimens used
for 4 include type 7.3

	opistho.	M	LACM6906 42653 est85	priscus	mitchelli	type calhouni	incepto
Gr. length	77.5-84.9 (82.7)			80.5-82.7 (2)	98.0 (new)		
Length to deltoid	61.3-67.4 (65.2)		67.2	63.8-64.8 (2)	76.6	7.0	8.8-9.0
Br. conds	7.0- 7.7 (7.4)		7.7	7.3- 7.9 (4)	8.6-8.9		
Depth int. condyle	8.2- 9.0 (8.6)		8.4	8.8- 9.0 (3)	10.2	7.9	9.6
Shaft br	3.0- 3.2 (3.1)		3.5	3.2- 3.4 (4)	4.1-4.2 (3)	2.9	3.7
Depth sh.	5.3- 6.0 (5.4)		5.7	6.3- 6.8 (4)	6.7- 6.8	5.8	5.9
Ht. ectepi process above dist. end	9.0-9.9 (9.6)		9.5	9.7-10.1 (2)	11.1-11.6	9.4	10.3
Ratio br/ depth sh.	52.5-58.5%		61.4%	48.8-53.0% (4)	60.2-62.6%	50.0%	62.7%
Ratio ht. ectepi.proc. to length to deltoid	134.1-15.3		14.1%	15.5 (1 new)	15.1 (new)		
to br conds. 125-131			123%	131-132%	128-130	134	117

Depth ulna
to br. deltoid
to length

113-119%
12.9-13.6

109.7
11.4%

112-118%
13.8-13.9

114%
13.3

113%

111%

Gr. length
P. diatomicus
77.1-82.6 (79.8)

P. felthami

P. kanakoffi

Canakoffi type

Length to
deltoid
59.8-66.3 (63.2)

71.2

63.2-64.5 (2)

64.6

Br. conds.
6.8- 7.3 (2 only)

8.4

7.2-8.0 (2 only)

7.4

Depth int.
condyle
5x0x 7.7

10.0

8.3-9.0

8.4

Shaft br.
.....

3.5

3.1-3.5

3.4 mid

Shaft depth
7.9?

6.8

5.5-5.8

5.4 mid

Ht. ectepi.
above dist.
11.6

10.9

9.0-10.0

9.0

9.9? with inc.
length 60.1
LACM raised cast

Ratio br/
depth sh

.....

51.5

56.5

Ratio ht.
ectepi to
conds.

176%

130

125%

Ratio ht. ectepi
to length

18.2

10.3

12.3

Ratio depth ulna
to dist condyle

116

119%

116%-119%

113.5

An excellent cast (mold) in relief of *P. diat.* ^{hols} *typo*
 reveals the dist end of the lunium showing the clefts and
 process to be 11.6 mm above the dist end & extremely well
 above the brachial imp. Also brachial up is
 larger than in 42652

Depth sh 24mm

Depth ant 7.75

Br. cross. 6.6

Length & depth ^{ant} tip 63.7 (69.8 in 42652)

St. length — 80.2

Length ulna 73.4

Dist. br. dist. ulna 7.4

Depth ant brach. ulna 5.4?

1976
copied from
many old records

Puffinus hysan

	prince	mittchell	diatom.	calhoun	peterson	kanakapoi	apuktho	42682 see 6906 ✓
Length distend to distal deltid	64.0	66.9	—	—	—	—	60.8-67.0	66.9
Br. dist. condyles	7.5 ± 1.8140	8.9	7.5-7.5? (2 specimens)	7.1	8.5	7.3-8.0	7.0-7.5	7.7
Length prox to dist end deltid	18.6	22.6	—	—	71.2	—	18.2	—
Complete length	82.6 18140	98.3 7. (88.3)	80.6 77.4-87.8 82.6	—	90.2	80.5	77.5-85.0	85.7 based on apuktho
depth x br. ch middle	6.1 x 3.6 59.1%	6.4 x 4.5 70.3%	5.9 x 3.3 54.6%	6.9 x 3.8 56.9%	5.4 x 3.4 59.9%	6.1 x 3.3 5.9 x 5.3 56.2%	6.1 x 3.3 5.9 x 5.3 56.2%	5.8 x 3.9 60.9%
depth x br. ch above [back, impress. [not above ectephi]	6.2 x 3.4 55.2%	6.7 x 3.2 50.7%	5.9 x 3.0 [6.4 x 3.4] 51.9%	5.8 x 3.0 51.9%	5.5 x 3.0 [6.3 x 3.95] 54.9%	5.4 x 3.0 [4.4 x 0.7] 54.9%	5.4 x 3.0 [4.4 x 0.7] 54.9%	6.0 x 3.6 60.9%
Ht ectephi condylar proc. above midtend (to tip, process)	10.2	11.6 10.5	11.6 8.6-10.3	11.0	11.0	9.5-10.0	9.5-10.0	9.9 base 9.4 tip
Ratio ht ectephi to br dist ends.	136.0%	108.9%	135.9%	129.5%	—	135.5-133.5	135.5-133.5	122.0 (tip)
Ratio ectephi to on length	12.3	10.7%	14.3% 10.8, 10.7%, 13.2	—	—	11.8-12.25	11.8-12.25	12.2
Ratio ectephi to length to distal	14.8%	15.7	—	—	—	14.9-15.6	14.9-15.6	14.2%
Ratio br to depth sh.	58.7%	70.3%	—	—	—	56-65%	56-65%	67%

Puffinus ulua

	talaput	Baleon Cayn shimmer	
Length to condyles	69.2-75?	7?	68.7-71.1
to olecranon	72.-79.	85.7 ↓?	72.8
prox breadth	6.6	7.1	6.4
depth prox	7.9	8.2	7.75-8.4
g. dist breadth to tip of process	—	7.4	—
dist depth ext.	—	6.0	—
br/depth sh (above mid)	—	4.0/5.0 3.6-4.6	3.9/5.2 3.6-4.6

check ht of ectephi condylar process
on diatomicus it is above the level
of the impression of brach. ant. muscle

check depth of brachial impression of humerus
Process + brachioephi shallower than calhouni
and with pit at lateral edge of attach ant. art. lig.
attach ant. art. lig in prince more lateral than calhouni.
to flat

Check all
diatomicus

Check the following characters of the ulna from 4.9.06
Size and placement of impression for brachialis anterior

P. kanabikpi differs from *P. quistus* -

impression broader & of greater extent anteriorly.
Surface of shaft below the impression is flat
in *quistus*, more convex in *kanabikpi*.

P. calhouni - surface for brachialis anterior begins
6.4 mm below cotyla distinguished from *kanabikpi* 5.0
does not extend along side of attach. ant. art. lig. 3.8

Attachment of ant. art. ligament

P. kanabikpi - forms deep crescent with convex side
pointing distally; with anterior arm of
crescent slightly more extended proximal
than palmar arm (as in *P. quistus*)

P. priscus - shape more tear drop like than crescentic
and well swollen. Shorter than in *kanabikpi* or
quistus, & more palmar; less distance bet. attach. cotyla than in
kanabikpi & *quistus*

P. calhouni - shape is ^{more} long & oval; no depression
between prox. end of attachment and
int. lig. of cotyla. Terminates well below level
of distal tip of ext. cotyla

Papilla below ext. lig. of cotyla

✓ *P. priscus* - papilla touches ext. lig. of cotyla & is
better formed than in *quistus*, but this
may vary with age (some *quistus* have
almost no papilla) when present, however, in
quistus it is smaller than *priscus* & not as close
to lig. of cotyla, less horizontally placed.

P. kanabikpi - There is a "surface" here, but no raised
papilla.

P. calhouni - no papilla under ext. cotyla but a line
from cotyla to shaft.

Loc 6906 Paffius

Humerus 4265'2

Length est. 86 ^{85.8}

Br. dist condyles 7.7

Ht. dist cond. — 94-99
near base

Depth int. condyle 8.4

" ext " 6.5

Depth/br shaft
above dist end 60/36

Depth/br sh
at middle 58/39

Distance ext condyle
to dist. end deltoid 67.7

Length ext. process - 38+

br base " 3.7

Ulna 4265'4

Length to int. stylo 68.2

est. total length 72.0

prox br. condyle 6.4

G. dist br 6.4

Depth ext. tuberos 53

Depth/b. sh middle - 4.3/3.5

Shaft heavier & less deep
humeral than pinnus

In length 2 max

epistoma 55.9 but shaft
is thicker (laterally) ~~more rounded~~
almost the same depth middle
above dist end, diameter 11

~~depth 11~~

~~depth 11~~

shaft (fossil has high
curve at least 9 degrees

as in temerata (rounded)

is slightly. Dist ends

prominent in pinnus,

rounded in mitchelli

Thomomys specimen is older

pinnus shaft flat

#14697
Ulna from 65' shaft both

depth dist 6.3 6906-5.3

br. tub. 5.3 " 4.2

	Depth mm	Loc 6906	Depth Ulna	Br dist cond. mm	Sh diameter mm 4265'2	Ulna 4265'4	
22.6	98.3	17500 Loc 1025 mitchelli	72.8	7.8	3.9 x 5.85	3.5 x 4.3	
18.6	82.6	18140 Loc 6688 pinnus		8.9	4.9 x 6.4		66.9 dist end
		opistho		7.5	3.6 x 6.1		64.0
18.9	85.0	max 55.0	78.5	7.5	3.3 x 4.9	3.4 x 4.45	67.0
17.4	77.5	max 55.0	70.6	7.0	3.3 x 5.1	3.4 x 3.9	60.8
Gulston 13.2	67.7	oblique suboblique	60.6	5.9	2.7 x 3.8	2.6 x 3.4	
May. 22.1	101.5	paracuneate ulna near humeral	104.6	8.5	3.9 x 5.1 - 3.9 x 4.8		
26.5	118.5	Grams	116.7	9.5	4.5 x 6.5	4.3 x 5.1	
21.8	99.6	transverse	98.7	8.7	3.7 x 6.4	3.7 x 4.9	
22.3	82.3	opistho	84.2	7.2	3.3 x 5.2	3.3 x 4.5	
23.3	106.0	66.0	101.5	9.5	3.9 x 7.3	4.1 x 5.4	
24.1	113.7	crealys	111.5	10.2	3.1 x 4.1	3.2 x 4.0	
18.5	84.8	opistho	78.7	7.2	4.4 x 5.9	4.5 x 4.8	67.3

Subgenus	Measurements		humeri		Pecent		Puffinus		depth	int condyle	1 head on pinnar	length	length	deltoid
	length to int. condyle	least dist. below center	ap. dist. at same place as;	Gr. condyles	diag. to dist. end	ectepi. max. at base	ectepi. min. at base	protuberance from shaft						
<i>Ardea</i>														
<i>P. gravis</i> 18873	118.1	15.190	4.5	6.5	9.8	12.3	5.0	11.0	5.9	6.5	27.3	11.9	15.3	20.3
											20.3			11.3
<i>P. creatus</i> 8749	114.1	18.2%	4.3	6.3	9.8	13.3	4.9	11.3	5.6	6.9	23.7	14.7	15.8	21.4
											20.4			12
<i>Subgenus Thylodroma</i>														
<i>P. creatus</i> 1375	100.7	22.4	3.7	5.0	8.2	11.1	4.4	9.9	5.3	5.7	22.5	10.4	13.1	20.3
											18.4			10.1
											20.3			
<i>Subgenus Puffinus</i>														
<i>P. p. opus</i> 553	84.9	22.6	3.0	5.4	7.4	10.2	3.2	9.5	4.9	5.5	19.2	8.7	11.5	15.9
											15.8			8.8
<i>P. tenuirostris</i> 1118	100.1	23.8	3.5	6.3	8.9	11.8	4.3	10.9	6.1	5.9	23.9	10.2	13.7	19.3
											19.3			10.3
<i>P. griseus</i> 50	104.2	23.5	4.0	7.5	9.4	12.8	4.0	11.4	5.7	7.2	24.5	10.2	14.0	20.6
											20.6			11.2

Puffinus Tertiarius

Ulna

Ulna

loc. 1075 B

P. kanakoffi - Plio S. D. 2821

P. opistho confus

Length 55.7 (to olecranon)

78.6 - 70.7

Pr. prox 7.1

7.0 - 6.6

Depth 11 8.2

8.4 - 7.75

Pr. dist 24 (greatest, including tip of process)

Depth ext 6.0

Pr. depth 40/5.0 (above middle, at end of scar) 3.9/5.2 - 3.6-4.6

attach. lig 5.6 (least distance to acromial edge 4.3) 5.6 - 4.6

P. kanakoffi in size and general appearance very much like

P. gisnomelas.

- ② Attachment of ant. art. lig. forming a deep, ^{convex side pointing distally} crescent, ^{shaped} with acromial arm of crescent slightly more ^{extending} prox'ly than palmar - as in *P. opistho*.
- ③ Main distinction from *P. opistho*. lies in the ^{size & placement of the impression of the brachialis anticus muscle} which is slightly broader and extends further acromially; the ^{anterior} side of the shaft in this area, and immediately below, is more convex; this surface is flattened in *P. opistho*.

P. priscus (referred from Shearwater Rio 17503)

Pr. prox 6.6

on br. back wing 2.0
least distance from wing to acromial edge 1.5h. 4.6

depth 11 7.9, 5'

attach. lig 5.0 (diag. length)

Segmental attachment shorter than in *P. opistho* or *P. kanakoffi*. ^{more palmar in position & also} with much less distance between tip of ant. coryla & prox edge of attachment. Shape of attachment more ^{sharply} ^{curved} than ^{mind below & towards} ^{ext} ^{lip} of coryla. Seems to be better formed than in *P. opistho*, but this apparently varies with age, as some *opistho* have practically no papilla, but where well formed it is smaller & not quite so close to tip of coryla (534 & 556) & less horiz. placed. On *P. kanakoffi* there is a "surface" but no raised papilla.

P. californi Pr. depth 6.6 / 7.7 prox end; 6.7 length of ant. art. lig. attach. Attach. ant. art. lig. long + oval, no depression between prox end of attach. & ant. lip of coryla. Nearly parallel to shaft in position (less diag. than in *kanakoffi* or *priscus*). Surface for brachialis anticus begins 6.4 mm below coryla as compared 5.0 mm *kanakoffi* & 3.8 mm *priscus*. 1.9 mm to brach. wing. Least distance to acromial border of sh 4.0 (depth sh here 4.9). No papilla under ant. coryla but a line from coryla to shaft.

March 22, 1976

barnesi
Puffinus niguelensis new species

Holotype: Right humerus lacking proximal end, LACM 42652,
collected by

Formation and Age: Monterey formation, Clarendonian, Late Miocene

Type locality: LACM 6906

Diagnosis: Comparable in size to *P. opisthomelas* but shaft more rounded, less blade-like (breadth more than 60% of depth of shaft).
~~Internal condyle~~ ^{Distal end} relatively short in anconal-palmar dimension, and anconal tip swollen laterally with small depression below swelling. Brachial impression shallow, broader laterally than long proximo-distally. Ectepicondylar process relatively short distance above distal end, ^{ratio?} not ^{even with} extended above brachial impression. Attachment for anterior articular ligament turned slightly laterally rather than directly palmar.

Measurements: Length from distal end to distal tip of deltoid crest 67.2mm., breadth distal condyles 7.7mm, depth internal ^{side distal end} condyle 8.4mm, height of ectepicondylar process above distal end 9.5mm, shaft dimensions ^{br} 3.5 x ^{depth} 5.7 mm.

Referred specimen: Left ulna, lacking olecranon LACM 42654 from type locality. Is probably of the same species. Although it is relatively smaller than would be expected for the wing of one individual it falls within the size range of *P. opisthomelas* -- near the minimum, as contrasted to the type humerus which is near the maximum size of *P. opistho.* The specimen is too poorly preserved to observe important qualitative characters. Length to intercotylar ridge 70.8mm, breadth proximal cotylae 6.5 ap.mm, greatest distal breadth 6.4mm, depth external trochlea 5.3mm, shaft dimensions (middle) 3.5 x 4.3mm.

~~Dist. ulna~~ 52748, Dz Ph 1 no. 2 loc 3185 Check size
of fragment
Close to *P. karachoffi* in general size but distinguished by more
long, placed brach. tip not extending above level of deltoid process
attach for ant. art. lig. turned more laterally; shaft more rounded less
blade-like above ectepicond. process

Ulna with attach for ant. art. lig. ^{seamly} more proximal than in *opistho*

but this area is broader

length to intercotylar ridge 71.2

br depth 6.1 x 5.3

br depth mid

3.5 4.3

7.2 6.1

3.6 4.6

karachoffi
2321
1/1/76

carpal proc (dist) shorter than in *karachoffi* & more abruptly projected (more like *opistho*)
ext condyle less prominently projected palmar ridge from cotyla to shaft

Discussion: Humeri, either casts or original material, of the following previously described species of North American fossil shearwaters have been examined

- ✓ ① *P. conradi* Marsh, Middle Miocene of Maryland
- ③ *P. diatomicus* Miller, Late Miocene of California ✓
- ✓ ④ *P. inceptor* Wetmore, Middle Miocene of California ✓
- ⑤ *P. kanakoffi* Howard, Late Pliocene of California ✓
- ✓ ⑥ *P. felthami* Howard, Middle Pliocene of California ✓
- ✓ ⑦ *Puffinus mitchelli* Miller, Middle Miocene of California ✓
- ✓ ⑧ *P. priscus* Miller, Middle Miocene of California ✓
- ✓ ⑨ *P. calhouni* Howard, Late Miocene of California ✓

Included in the study are additional specimens of *P. mitchelli* and *P. priscus* from the Sharktooth Hill locality discovered since the last report on the site.

P. conradi, *P. mitchelli* and *P. felthami* are all larger than *P. niguelensis*. *P. inceptor* agrees in some dimensions, but the marked medial thrust of the internal condyle and entepicondyle and the small distal condyles are distinctive of this species.

An excellent latex mold made from the holotype slab of *P. diatomicus* (the original is an impression in diatomite) clearly reveals characters of the palmar aspect of the humerus. The brachial impression is more distally extended than in *P. niguelensis* and the ectepicondylar process is placed higher above the distal end, actually above the level of the brachial impression.

In both *P. priscus* and *P. calhouni* the shaft is more compressed and bladelike than in *P. niguelensis* (ratio of breadth to depth of shaft: *P. priscus* 48-53%, *calhouni* 50%, *P. niguelensis* 61%).

P. micraulax Brodkorb, from the Lower Miocene of Florida is also known from the humerus. ~~The specimen was not examined.~~ The condylar measurement, 5.4mm presented by Brodkorb (1963) clearly shows it to be markedly smaller than *P. niguelensis*.

P. tedfordi from the Pliocene of Baja California, Mexico is known only from the tarsometatarsus. Although the specimen suggests a stouter bird than is represented by the wing of *P. niguelensis*, this remains to be proven. Of the three European fossil shearwaters, *P. arvernensis*, known from the tarsometatarsus, is also robust in proportions. *P. raemonckii* (described under the genus *Larus*) were both described from the humerus, the former apparently larger than *P. niguelensis* judging from Lambrecht's comment (1933:), "a large gull." *P. anticla* was described from a proximal humerus "larger than *P. capensis*." Possibility of comparison with *P. niguelensis* must remain for the future.

P. hawaiiensis

Length	44.1	47.2	2116	2140	2648	6906
Depth	64.1	67.2	63.8	—	—	67.3
Width	9.0	9.6 ? broken	9.2 ? broken	9.5+	—	9.5+
abr sh	3.7	3.8	3.3	—	3.6	4.0
at top of	2.0	2.0	6.6	—	6.7	6.5
br dist	7.4	—	7.8	7.6	—	7.7
condyle	8.4	—	8.8	—	—	8.4
depth int.	2.2	—	2.1	—	—	2.4
br. around	3.4	3.7	2.9	3.4	3.5	3.9
edge int. condyle	5.4	5.6	4.9	5.7	5.7	5.9
abr sh	2.5	—	—	—	—	3.6
condyle	4.5	—	—	—	—	3.2
depth int.	52.9%	54.2%	50.0%	—	53.8%	61.6%
abr sh	62.5	66.0	59.3	63.1	63.6	66.1
condyle	55.6	—	—	—	—	112.9%
depth int.	3.0	3.3	2.6	—	—	3.8
abr sh	5.6	6.2	5.4	—	—	5.8
condyle	53.7%	53.2%	48.2%	—	—	76.0%

~~There is little likelihood of identity with P. rasmarchii~~
 The European sps have not been compared.
 Age alone would rule out P. rasmarchii. P. arvensis
 like P. kofoidi is known from a tarantula
 P. agutaneus + P. antiquus

Diomedea

Dear Hildegard, ^{Or made for both. ~~It~~ is not} Macronectes, Pierre ^{Gourbault} 4 May 1976

I compared humeri and TSM chaeis. with Macronectes + D. cauta (following Wilkenson). TSM about same size in both, length ± 95 mm. Humeri of D. cauta much longer $300 \pm$ vs. $240 \pm$ in Macronectes, but prox. end $\pm$ same width.

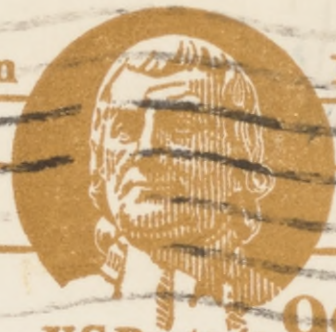
Macronectes humeri (1) strong median ridge on anterior face distal to head. (2) Tricip. fossa very large & open w/ a few struts but not shelved over & w/ the small pneumatic foramen of Dionidea. (3) big. furrow on palmar side deep, though short. (4) Caput narrow, curved, & swollen, not wide as in D.

TSM. Macronectes (1) Shaft more slender, prox. wd. slightly less, distal width $\pm$ equal in both genera. (2) Hypotarsus w/ 2 well developed grooves instead of only 1 in D., which has only 1 good groove & the outer part of the hypotarsus wider & almost flat. Trochleae more delicate. Can't make out much detail from L.M.'s photograph. Let me know if you want to borrow both sp.



John Witherspoon

Patriot



U.S. Postage 9¢

Dr. Hildegarde Howard
2045-Q Via Mariposa East
Laguna Hills, Calif. 92653

relative size	Diomedea calif	exulans	albata
		106.7%	
Type 1, taurinoid	86.4%		99.0
Sh tooth 6658/1839	76.2		
Sh ? Caspianoid	84.7		106.8
6658/5007 ulian	97.9		118.2
6906/37629 duffin	84.4		
6902/5854, ^{new} hunch head a del tooth	78.0		
		1018139	
Lornita	76.0%	106.5	105.9
Length Caspianoid			
Throat M 1	83.7		
Length PH 1			
			120.0
Type taur	95.6		
th draft	95.2		117.9
depth n			
Cr. sh Lornita ulian	100.2%		
dr. sh. d. sh. n. radius	100.4%		

73 - Anza-Berrego

123 - waves 6 tips exulans 46.2 - nig.
147, 8 Aechmura wa? " - 91.2 - nigripes
(1302) p. 629.1

Wilkinson Paper 1969

Diomedea thyridata Wilkinson
upper mid. Cheltenhamian,
Beaumaris, Victoria

Prex $\frac{2}{3}$ upper mandible 68.5 mm
probably total 100-105

max width 22 mm (est. allowing for shaded
condition)

ht. 26.2

thus compared with *D. chlororhynchus* Gmel.
of Queenscliff, Victoria

four slightly larger

+ able skins size - must comparable to

← *Diomedea melanophrys* (98-103 mm)
width 24-27 Victoria (leaves long)
ht 28-31

or *D. chlororhynchus* (100-114 mm long)
width 23-24 Vict. ^{30'} Aurbain
ht 27-28

or *D. chrysostoma* length 96-104
width 22-26
ht 28-30

exulans given as length 150 from Port Campbell
width 40.5 Victoria
ht 35.3

cauta given as length 113, width 28.4 ^{30.2}, ht 33.5-34.1
Tasmania, Victoria

Wilkinson says - thyr data
descent to melanophrys exulans

Wilkinson groups Diomedaeas

A D melanophrys group - mgout of snail
albatus - includes phycostoma
~~chlorophrys~~ virorata
- chlorophrys

B D exulans group - largest living form
exulans + epomophora
and albatrus

also includes nigripes but this
sp. is somewhat atypical in
some respects

Deep Thyridata not related to this
group.

Wilkinson says:

^{multicaud} D. ^{slightly} anglica larger than albatrus larva

Wilkinson himself believes D. calif. is
approached in size only by D. canta but
resemblance is not close

Says D. canta larger + stouter than
albatrus or anglica but much thinner than
exulans. It is $\frac{2}{3}$ the length of anglica as

figured by Sydeman

suggests that D. calif. resembles
Macronectes giganteus (Grand Petrel)

less than
known in
calif. no
canta must
be sp.
separate

List of Diomedea from A.O.U. Checklist

Diomedea albatrus Japan to Alaska + Calif.

D. nigripes Hawaii to Aleutians + Bay of Calif.

D. immutabilis Pac. Coast Japan to Alaska
+ Bay of Calif.

D. melanophrys (N.Z. + So. oceans
occas. Greenland, Norway)

D. cauta - So. Indian Ocean + So. Pac.

less common in So. Atlantic.

accidental in No. Pac.

D. chlororhynchos - So. Atlantic,
Indian Ocean - Gulf St. Lawrence
main

Leg Wing Bones ~~from~~ D. calif. - from Shalkbath Hills Miguel
D. meleni

	fossil number 2, Shalkbath Hills 100,668 not published	exulans	90% exulans	Type piv ulna	14.4	miguel 17.6
carpo. max depth	22.8	25.7	88.7%	length carpo.	66.8 111.39	100.5 132.5
ulna br. sh. palmar side	LACM 50617 100,668 11	13	84.6	71.90 94.13 95.3		
dist humerus	Shalkbath Hills LACM 16468 27.5	LACM 31.6	87.20	Se. 6688 Shalkbath Hills		
dist femur	type D. calif. 9.0 20.6	23.9 22.3 23.2	86.2%	miller specimen 9.0 exulans		
prox humerus	Shalkbath 91440 58544 40 (39.2) 7.40	57.4 (47.4) 77.4	84.5%	Miguel		
humerus prox length dew/delta	Miguel 58544 64.5	82.7	78.0			
humerus br sh	11 x 1.4	13 x 18.4	84.6%	81.5%		
br hind dist rec below	6906/37629 19.5	20.00	97.5%	albatrus #14		
br papilla	21.1	21.3	100 -			
ulna br at distal	15.0	15.5	96.7%	12.9		
ulna depth	int. 9.9 ext. 10.8	int. 10.0 10.9	99.0 99.2%	int. 8.2		
depth ext cond. thin	18.9 mic	19.6	96.5%	15.7		
br shaft depth	10.75 7.8	10.7 7.9	106.20 98.70	8.5 5.9		
br shaft br. to surface	14.8	11.5	93.20	12.7		
br shaft br. to surface	19.7	20.1	98.60	15.7		
br shaft br. to surface	4.25	4.2	90.40	2.0		
br shaft br. to surface				2.8		
br shaft br. to surface				4.7		

Family Pseudodontornithidae

Osteodontornis orri

Three fragments represent the bony-toothed birds: a portion of lower jaw (no. 42656) with a single "tooth" from locality 7136 and another lower jaw fragment (no. 22444) with several "teeth", and a carpometacarpus with portion of proximal end and shaft (no. 53906) from locality 6902.

The jaw fragments resemble previously recorded (Howard, 1957 and Howard and White, 1962) specimens of Osteodontornis although they seem somewhat smaller than the type of O. orri.

The carpometacarpal fragment, however, conforms in size to the type of O. orri, in fact the specimen fits exactly into the impression of the left carpometacarpus, in which the large pisiform process has left a deep depression. The present specimen clarifies characters only suggested in the type, namely the length of the process of metacarpal 1 and the great compression of ~~the~~ metacarpals 2 and 3. A very thin metacarpal 3 is pressed against M2 even below the proximal metacarpal symphysis, and the symphysis extends almost to the level of the distal tip of the process of metacarpal 1. Metacarpal 1 is similarly broken in both the type and in no. 53906, but the area of its attachment to the element as a whole is ~~present, in~~ ^{indicated} and measures ~~Relative to the length of the carpo-~~ ^{62.2 mm.} Enough of the proximal end is preserved to note the presence of a well-developed, large pisiform process with a deep foramen above it. The proximal trochlea measures approximately ~~13~~^{15.5} mm in breadth. The antero-posterior dimension cannot be measured but it is obvious that the posterior portion is short in distal extent.

If the complete element equalled in length the one represented in the type, the specimen from locality 6902 represents about half of the total element (from trochlea to broken end of metacarpal 2 measures 126.4mm). Shaft breadth of metacarpal 2 measures 11.2mm, depth through M2 and M3, 16.4mm; M3 alone 4.2 mm across.

Niguel
Four fragments are assignable to *Diomedea*, three of which are larger than *D. albatrus* and are possibly assignable to *D. californica* described for Sharktooth Hill. The fourth is a smaller frag. of tibiotarsus distal end, unfortunately none of the elements agree with those known from Sharktooth Hill and direct comparisons are therefore impossible. The larger specimens may possibly represent *D. calif.* (see below)
Specimens known:

Type: distal tarsometatarsus UCMP 61392 Sharktooth Hill, Miller 1962
distal breadth 20.6 (albatrus 19.3, exulans 23.9)

Referred: Distal humerus LACM 16468 Sharktooth Hill (Howard 1966) loc 1625
Gr. br. dist. 27.5 (albatrus 26-26.7, exulans 31.6) 87909 exulans
Distal femur, badly eroded LACM 7431, ident. ??? HH 1966 loc 1625

Possible referral: pedal phalanx LACM 18271 from LACM loc. 1945
Nearly equal to exulans in size

Unrecorded: Sharktooth Hill locality 6688, prox. carpometacarpus
prox. depth 22.8 (exulans 25.7) LACM no. 18139
Distal femur, distal breadth 20.7 (exulans, 23.8)
Prox. carpometacarpus LACM 57170 from LACM loc. 3360

Sharktooth Hill locality LACM 1655: Dist. femur, prox. tarsus
LACM 33148; prox. scapula LACM 41439 and prox. tarsus
LACM 41440

Sharktooth Hill Loc. 1557 dist. tarsus LACM 18203 21.6 mm dist
Sharktooth Hill loc. 6688 prox. frag. ulna br. shaft
palmar side 11 (exulans 13, albatrus 10.3) LACM 50617

Specimens from Laguna Niguel:

LACM Loc. 6906 ① Distal tibiotarsus 37629 br. 19.5 (exulans 20.0,
albatrus 16.5) br. shaft 10.3 (exulans 9.8, albatrus 9.3)
② Distal radius 31172 (br. 10.1, exulans, 11.5)

LACM 6902 ③ 3/4 humerus (proximal end) LACM 58544
prox. br. (approx.) 40 (exulans 57.4)
distance head to tip deltoid crest 64.5 (exulans 82.7)
shaft at middle 11 x 15 (exulans 13 x 18.4)

★ See below also - smaller *Diomedea*

Wing impression from Lomita:

Length of carpometacarpus 100.5 through M1

Locke's Sharktooth Hill carpus 18139 same meas. 94.3 loc 6688 (*D. milleri*?)
Exulans same measure 132.5

Length Phl D1 51.4 (exulans 61.1)

Albatrus carpus length through M1 95.3

Diomedea milleri Type prox. ulna LACM 7319 Sharktooth Hill loc. 1655
Referred frag. shaft tarsus no. 16474, Loc. 1625

Br. cotylae type ulna 14.4 (*D. nigripes* 17.6)

Unrecorded, possibly *D. milleri* LACM 18139 carpo. 94.3 length
(d. albatrus 95.3 length loc 6688)

★ From Niguel locality 6906 frag. distal tibiotarsus 37674, smaller
than no. 37629 (the latter seems OK for *californica*)

★ *milleri* described *D. calif.* as equal in shaft diameter to exulans but
narrower across trochlear than adult *q. exulans*. Note same is
True of this 37629 from loc 6906 [*D. calif.* br. trochlear 20.6 (exulans 23.9)
③ *milleri* p. 471]

Jan 1969

A ^{U.S.} marine excavation for the North American Rockwell building ~~at~~ (now Gen. Service Ad. Bldg) on El Lago Ranch, in Laguna Niguel, Orange County, Calif., a ~~considerable~~ ^{main} collection of ~~fossil~~ ^{marine} mammals and birds was ~~found~~ ^{the} fossiliferous sands & shales of Monterey formation were revealed, ~~both~~ ^{the} fossil marine mammals and birds were collected ~~from the~~ ^{in the} actual bldg excavation and in adjacent hillside within a square mile of the El Lago site. Where located near the Los Angeles County Museum (LACM) numbers 6906 (in the bldg excavation), 6901 and 6902 in hillside on El Lago road, 3185, ~~for the~~ ^{to the} ~~main~~ ^{San Juan} Ranch and 7136 on Moulton Parkway to the NE. The mammalian fauna is being studied by

Lawrence Barber.

Bones	sp.	Notes	Count
1	1	Paridae ³⁶⁰⁷ ^{which are identifiable}	2 bones 2 sp.
2	2	Diomedidae	60 (4 sp.)
5	2	Diomedidae ^{sp.}	1
3	1	Pseudodendrochelydidae	27 (3 or more sp.)
13	2+?	Sulidae	2 (1 sp.)
	1	Anatidae	27 (5 sp.)
11	3	Alcidae (1 maclelleni sp.)	(2 maclelleni) 9 bones sp.
36		6 bones	

Bones	Loc.
3	3185
6	7136
20	6902
21	6906

Regarding W. H. Henshaw's suggestion that *D. calif.* may be related to Macronectes giganteus rather than to *Diomedea*.

I do not have the type of *D. calif.* before me but another

Tarsometatarsus from the Sharktooth Hill Bonebed is now

available (I A C M # 41440 from L A C M loc. 1655).

~~The specimen is as large as the type and the specimen is smaller than the type but compared with the type it is much larger than the type.~~

Peter Broadbent has kindly checked the characters like the humerus from the Nigel locality. This tarsus is clearly *Diomedea* not *Hydrobatidae*. Particularly notable is the single ~~hypotarsal~~ ~~groove~~ & the broad almost flat portion of the hypotarsus towards the next side with a slight deeper groove between this & the ant. calc. ridge.

This char. Dr. Broadbent has also checked for me on his specimens of *Diomedea* & *Macronectes*.

ls. depth
8.3 x 6.4 shaft 41440

DIOMEDEA

Diomedea californica? Humerus 58544

39.4 b. prox ext tub. to edge of bicapital crest below int tub.

32.4 same nigripes 1268

33.4 " " 1390

48.7 " exulans 230 glauca

16.5 " fulmar 672 glauca 64.1 head to dist end deltoid 61.4%

58.5 length int tub to dist tip deltoid 54.7 (% prox to dist length 59.2%)

50.4 same nigripes 1268 539 60.9%

50.1 " " 1390 539 59.4%

74.7 " exulans 230 51.7 61.4%

241 " fulmar 672 26.8

Company with humerus ^{of fulmar as representative} the family *Hydrobatidae*, it is ^{formed to be} ~~Hydrobatid~~ ~~Puffinidae~~

The humerus is clearly *Diomedeidae* ^(intrapular) ~~Puffinidae~~ in the following characters:

The acromial area below the head is broadly rounded, there is no real fossa under the int. tuberosity just a small fovea.

The distal tip of the deltoid slightly bulbous. (The complete deltoid & the bicapital crests are not preserved)

The big. furrow is shallow (much deeper in fulmar)

Dr. Pierce Bradshaw has kindly checked these chars. for me on specimens in his coll. and assured me that ~~the above characters used for~~ ~~Diomedidae as well as for fulmar~~ ~~is typically Hydrobatid as the upper~~

3172 Radius 11.7 14.6 #230

bulge 9.5 13.8

depth 7.1 9.2

maximales as well as for fulmar is typically Hydrobatid as the upper

146.5 117.0
116.8

Wilkinson, H. E. 1969

Description of an Upper Miocene albatross from Beaumaris Victoria, Australia, & a review of fossil *Diomedidae*.

Mem. Natl Mus. Victoria #29 pt 41-51 pl. 4

inc. teeth

Measurements of distal tibiotarsus 37629 from Loc. 6906,
Diomedea californica?

		compared to exulans	albatrus
breadth to surface of ext.cond. (edge broken)	19.5	20.0	16.5
Breadth at level of bridge	15.8	17.7	13.6
Breadth shaft	10.3	9.8	9.3
Depth shaft	7.7	8.1	6.2
Depth inter- condylar area thru bridge	11.5	13.3	10.1

Note: Miller described D. calif. (type dist. tarsometatarsus)
as larger and stouter than D. albatrus, "equal in shaft
diameter, but narrower across trochleae than adult female
D. exulans."

Diomedea anglica is referred by Wetmore from
Plio. Fla (Pliocene) (p. 10)
br. condyle 20.3 (D. albatrus 16-18)
more slender distal end than exulans
Type of D. anglica from Plio. Fla. br. tarsus pos
sibly 20.7 (per Wetmore measurements)

1957
So. Dakota

Lg. depth 80.90
 139 x 7.5 = 68.470
 9.9 x 7.9 = 78.210
 230 above dist. line but when
 raised only 10 dist. present (bony int. scale)
 terminal process

albatrus
 8.2 x 5.9 = 72.90

naysia 6.9 x 5.2 = 75.420

fovea 10.0 x 7.7 = 77.20
 locality 6000

37629
 albatrus
 9.2 x 6.1 = 66.320

11.7 x 7.5 = 64.720

9.8 x 6.6 = 67.390

14. x 11.7 = 69.390
 from line of top of body

11.4 x 7.2 = 67.320

Ratio upper br. to lower breadth

exulans 9.9 / 13.9 = 71.00

albatrus (1) 8.2 / 11.7 = 70.90

naysia 6.9 / 9.8 = 70.4

fovea 10.0 / 14.4 = 69.4

albatrus (2) 9.2 / 11.4 = 80.7

⑥ Diomedea

3.20.76

tarsus exulans prox tarsus 23.2 tarsus D. calif? from 1655 - 18.8 ap.
 tibia { dist tibia 21.1 tarsus sh " " " 8.2
 (to papilla ext) (90% exulans)
 in order to conform to fossil
 tarsus { sh mid tarsus 9.1
 dist br. tarsus 22.3 type D. calif. 20.6 [92.5% exulans]
 tibia { depth thru ext condyle 19.6 (at base to conform to fossil when
 " br. at bridge 4.6 projection some is broken)
 " depth thru area 10.4
 D. sp. from 6906 (#37629) tibia
 21.0 to papilla (condyle broken) 98.3% exulans
 18.9 depth thru ext condyle 96% exulans
 4.8 breadth at bridge (? 14.8?)
 10.8 depth thru bridge area

39.2 br. prox humerus (incomp.) 58544 from 6902 [48.5% exulans
 as nearly same prox
 meas as possible
 fossil broken at
 tip of dist. tub.
 14.3 in exulans 10.8 depth head " [75.2% exulans
 75.2% exulans 58.5 length from ext. tub. to dist. tip deltoid crest
 Resembles exulans in small pneumatic foramen
 in pneumatic foramen

Diomedea? californica from Lecombe 6906

A distal end of tibia tarsus 27629 represents a large albatross nearly equal in distal breadth & depth to a specimen of exulans in the Lecombe coll. compared to the same specimen of exulans, the type dist. tarsus of californica is 92.5% of the dist. br. of tibia. This difference is no more than could be expected within a series of the same sp.

Distal end of radius from 6906 + a prox end of humerus from 6902 are relatively smaller - the radius 88.9% of exulans in dist. br. The humerus 81.9% in prox breadth. If these bones referred to the same sp. as the tibiotarsus, the bird was markedly different in proportions than the modern species. Both radius & humerus are poorly preserved.

Humerus from Shafter, N. Mex. - distal 16468

Ratio to dist. end 16468 to exulans 86.9%

Humerus from 6902 prox 58544

Ratio to prox. end 58544 to exulans

42.8 OR

84.5% OR

81.7%

upper mea taken 1954
lower mea taken 1976
take your choice!!

Type tarsus (dist.) of D. Calif.

Ratio to dist. trochlear type

Muller specimen

23.9

to exulans

LACM spec.

22.3

to Muller's exulans 86.4%

to LACM exulans 92.7%

Tibia from 6906, #37629

Ratio to dist. end (coracoid
condyle bone)

37629

19.5

to exulans

97.6%

21.0

to exulans

98.6%

Ratio to dist. end to ext. papilla

37629

to exulans

Diomedea Bonas californica

miller

Shanktooth Loc 1655 - dist femur?

" prox scap

" prox tarso.

1625 - dist femur? recorded 1966

" humerus figured 1-I

1625 - prox tarsus
" ulna type

10.3 albatrus
ulna br shaft & palmar side
distal prox end 11.0 [exulans 13]
ulna sp. br. sh. 12.8 [exulans 17.9] [4 albatrus]
dist 5.6 [exulans 6.2]
18139

Loc. 6685 - carpometacarp. (sp.?) large D. calif. ? length
" " # 50617 prox frag. large ulna (lt M1/m2) 12.4
Loc 3700 # 57120 prox carpo. **SULTED**

Loc. 1945
Sumner Island
Diomedea sp. tarsal shaft # 17550
pedal phalanx # 18271 (diff. sp. than tarsus?)

Loc 6906
Niquel
D. calif. ? type cart. 20.6 tarsus
@ miller beques. distal prox end 2.9
br. 14.5
3729 Dist tibia [exulans 20.0] frag dist tibia 37674
31172 radius dist [albatrus 16.5]
10.1 [exulans 11.5]

Loc 6902
Niquel
3/4 Humerus # 58544
prox br. apoph. 40mm (broken) 64.5 distance head to tip deltoid crest
sh mid, 11x15 [47.4 D. exulans] [82.7 D. exulans]

UC 44x
Lomita
13.5 ht pic n1 [17.7 D. exulans]
10.1 x 8.0 breadth of shaft frag, ulna [9.8 x 8.0 D. exulans]

only impression
100.5 length carpometacarp. that ~~11.1~~
[132.5 D. exulans] [94.3 Shanktooth Hill # 18139]

4.3 x 5.7 dimensions shaft radius near dist. end
[4.2 x 6.0 D. exulans]

Length Ph 51.4 [61.1 exulans]

albatrus carpus 95.3 length through M1

Measure ~~in mm~~

Puffinus humerus collected by Raj Naidu Aug 29, 1974
said to be from Sharktooth Hill?

Looks very much like Niguel # 42652

(~~17502~~ ^{definitely} deeper depression (basal end))

Puffinus ^{pinnus} humerus # 18140 loc. 6688	Sharktooth Hill	probably pinnus Niguel
	Loc. 17502 loc 6688	Loc. 6906 42652
Length 82.6	175.2	151.2
prox. dia. 15.2	15.2	7.7
dist. dia. 7.4	7.5	8.5
" depth 9.0 int	9.0	9.5
ht. ectopi. 10.0	broken	
abundant		
X-X' dimension sh. 3.35 x 6.4	3.2 x 6.5	3.5 x 5.8
above distal end	broken	3.9 x 5.75
dimension mid sh. 3.8 x 6		4.6 x 5.5
" prox " 4.4 x 5.7	4.4 x 5.8	
Length dist. condyle		67.4
dist. end 64.4		
deltoid	49.3%	60.4%
ratio X-X' 52.5%		

6906 humerus distinguished from pinnus:

longer, less flattened shaft (less depth dimension)

smaller less depressed basal impression

(lateral br. about same, but narrower in prox-dist dimension)

dist. end broader laterally, narrower ^{depth} in 6906

1 June 1955
 23.148
 sh. Br. 20.0
 immed
 above ext.
 condyle
 & below
 attach.

sh. br. 13.0
 above
 attachs.
 + 17.5 mm
 above
 w/ condyle

Tarsus
 1557
 18203
 gr. dist 21.5
 br dist 22.3
 br dist 10.0 (10.17)
 2nd mid
 least
 depth
 sh
 prox
 br
 sh br
 below prox
 sh br
 mid

#230
 exulanz
 18.2

22.3
 9.1
 7.9
 23.2
 10.3
 9.0

D.
 California
 Type
 Tarsus
 1292
 UCM 66392
 20.6

9.1
 7.2
 —
 —
 —
 —

Shucktown
 Tarsus LACH
 1455
 91440

—
 8.0
 6.5
 18.6 we
 8.9
 8.2

Tarsus
 nigripes
 1390-1268

15.1-15.9
 7.1-6.7
 5.6-5.6
 16.8 (x2)
 8.2-7.5
 6.9-6.4

D. muller's who
 14.4 (mg 17.6)

Diomedea

Order Procellariiformes

Family Diomedidae

Genus Diomedea Linnaeus, 1758Diomedea spp. indeterminate

Referred material.-- Distal end of tibiotarsus, LACM 37629,
distal end of radius, LACM 31172; both from LACM locality 6906.
Proximal section of humerus, LACM 58544, from LACM locality 6902.
All are larger than in D. nigripes Audubon, 1839 or D. albatrus
Pallas, 1769.

Discussion.-- Four species of fossil albatrosses have been pre-
viously named, D. californica ^{Miller, 1962} and D. milleri ^{Howard, 1966} from the Middle Miocene
of Sharktooth Hill, California (~~see Historical Review, p. 664~~), D.
thryidata Wilkinson, 1969, from the Late Miocene of Australia, and
D. anglica Lydekker, 1891, from the Pliocene of England (type) ^{tarsometatarsus} and
Florida (referred, Wetmore, 1943).

In comparison with Recent species, D. milleri, described from an
ulna with referred tarsometatarsus (Howard, 1966), and D. thryidata,
described from a rostrum (Wilkinson, 1969), appear to have been species
whose size range was below that possible for the species represented
by the elements in the present collection.

D. californica and D. anglica, both described from the tarsometatarsus, were of larger size, with the type of D. californica being
heavier, though slightly shorter, than that of D. anglica (see Miller, 1962). Compared to a Recent skeleton of D. exulans Linnaeus, 1758
(LACM 230), the measurements for the distal breadth in the fossils,
as given by Miller (op. cit.), show D. californica to be 92.4% and D.
anglica to be 86.5% of D. exulans. Compared to the tibiotarsus of the
same Recent skeleton of D. exulans, the ~~Florida~~ ^{from Florida,} tibiotarsus referred

Another distal end of tarsometatarsus from Sharktooth Hill
is now available (LACM 18203). This ~~specimen~~ ^{specimen} closely resembles
the type of D. calif. except for larger size. ~~Compared to D. exulans~~
~~See 230. This is 96.4% of that of LACM 230 D. exulans~~

to D. anglica is 94.8%, and the tibiotarsus from Laguna Niguel (LACM 37629) is 96.7% of the distal breadth of the Recent species.

xn The referred tibiotarsus of D. anglica (MCZ 2328) was made available for this study. Compared to this specimen, the Laguna Niguel tibiotarsus differs in less depression of the supratendinal bridge and in having a well-developed, papilla-like internal ligamental attachment. In both of these characters LACM 37629 resembles D. exulans, whereas MCZ 2328 more closely resembles D. albatrus in which the bridge is more depressed and the ligamental attachment is only a scar. Both specimens differ from D. exulans in more horizontal position of the lower opening of the tendinal canal, but in MCZ 2328 the opening is more restricted in lateral extent than in LACM 37629.

xn → In referring the Florida ^{Sherrinen} tibiotarsus to D. anglica, Wetmore (1943) recognized the relative difference in size of the type tarsometatarsus. He noted, however, that in a large series of Recent skeletons of D. albatrus, the breadths of these elements varied as much as 2.3 - 2.4 mm. A similar variation in the fossil species might be expected. Applying the same reasoning to the tarsometatarsus and tibiotarsus from California, it is possible that LACM 37629 could represent D. californica. On the other hand, additional specimens of other elements of Diomedea from (recorded humerus, and unrecorded ulna and carpometacarpus) Sharktooth Hill suggest that the range was downward rather than upward from the size represented by the type tarsometatarsus.

of D. calif.
 referred humerus (Howard, 1966) and unrecorded ulna & carpometacarpus,
 all from the Sharktooth Hill Bonebed,

96.4
 223) 2150
 2007
 1430
 1338
 920
 892

Aug. 19, 1976

Comparison Fossil Specimens of
Measurements of Diomedea specimens
fossil and Recent D. exulans

	Fossil	Modern D. exulans LACM 230	Ratio of Fossil to modern D. exulans	range 2 only
Tarsometatarsus				
Distal breadth	20.6 ^a mm	22.3 mm	92.4%	16.5-16.5
Tibiotarsus				
Distal breadth	21.2 ^b mm	21.3	99.4	13.9-14
Breadth shaft	10.3	9.8		
Depth head	18.9	19.6		
Humerus				
Proximal breadth	39.2 ^c	48.5	80.9	31.6-33.3
Depth head	10.8 ^d	14.3	75.6	8.6-9.0
Length from head to end of deltoid	64.5 ^e	83.7	77.2	53.9-54.5
Distal end	27.5 ^e	31.6	87.0	19.8-20.4
Radius				
Distal breadth	11.7 ^f	14.6	80.2	

- a Type of Diomedea californica Miller (1962:471) referred humerus (Howard 1966)
b Tibiotarsus LACM 37629, Locality 6906
c Humerus LACM 58544, locality 6902
d Referred to D. californica
e Humerus (LACM 16468) from Sharktooth Hill (Howard, 1966)
f Radius LACM 31172, locality 6906

a Diomedea californica from Sharktooth Hill
Type tarsometatarsus (Miller 1962:471) referred humerus (Howard 1966)

Jan 1945

Phalange (pedal)	8.9	10.5	84.6%
Depth below prox end			

- a Type tarsometatarsus (Miller 1962:471) referred distal humerus (Howard 1966)
of D. calif. from Sharktooth Hill
b Laguna Miguel specimens

4	Michels	bone
71.8	15.9	6.6
73.9	16.1	6.7
70.1	15.8	6.75
71.2	14.1	6.6

a measurements marked a - refer to type tarsometatarsus (Miller 1962) & referred distal end of humerus (Howard 1966) of D. calif. from Sharktooth Hill. All other measurements are of Laguna Miguel specimens
~~distal humerus~~ in the text.

Fossils marked with * are from type (tarsometatarsus) & referred (distal humerus) of D. californica from Sharktooth Hill. Others are as described in text from Laguna Miguel as noted in above text

Table I

Comparison of Fossil and Recent Specimens of Diomedea

	Fossil		Recent	Ratio fossil to Recent	
	D. californica	D. anglica	D. exulans	D. calif.	D. anglica
Tarsometatarsus	20.6mm* ^{D. sp.}				
Distal breadth	20.6mm*	19.3mm	22.3 mm.	92.4%	86.8% ⁵
Breadth shaft	9.0 *	. . .	9.3	96.8*	. . .
Depth shaft	7.9 *	. . .	8.0	98.8*	. . .
Tibiotarsus					
Distal breadth	20.6	20.2	21.3	96.8 ⁷	94.8
Breadth shaft	10.0	9.5	10.0	100.0	95.0
Humerus					
Proximal breadth	39.2	. . .	48.5	80.8	. . .
Depth head	10.8	. . .	14.3	75.6 ⁵	. . .
Length from head to end of deltoid crest	64.5	. . .	83.7	77.2 ⁰	. . .
Distal breadth	27.5*	. . .	31.6	87.0*	. . .
Radius					
Distal breadth	11.7	. . .	14.6	80.2 ⁰	. .

*Fossils marked with asterisk are ^{D. calif.} from Sharktooth Hill. Other ~~D. californica~~ specimens are from Laguna Niguel.[^]

rewrite joint separate
columns for D. calif (Sharktooth Hill)
and D. sp. from Niguel.

Table

@ Miller "exactly same as albatross" wait to give as 19.3
Diomedea p. 2
proximal @ width 20.9

Measurements of Diomedea speciens

	Tarsometatarsus	D. exulans	Type D. calif.	tibiotarsus	humerus	radius
Miller exulans 23.4	distal breadth	22.3mm	20.6mm	.....	.....	.....
9.4	distal breadth	9.3	9.0	.....	.....	.....
8.3	Tibiotarsus	8.0	7.9	.....	.....	.....
	distal breadth	21.3	20.3	21.0	.....	.....
	depth externally	19.6	18.2	18.9	.....	.....
	breadth shaft near distal end	9.8	10.3	.....	.....	.....
	Humerus					
	Proximal breadth	48.5	.....	.....	39.2	.....
	Depth head	14.3	.....	10x10x	10.8	.....
	Length from head					
	tl end of deltoid	83.7	.....	.....	64.5	.....
	Ratio length/width	57.8%			60.8%	
	Radius					
	distal breadth	11.5				10.1
	depth	14.6				11.7
		9.2				7.5
	Prox. tarsus					
	prox br.	23.2				
	br. sh.	8.9				
	depth	6.5				

References: Miller, 1962. A new albatross from the Miocene of California. Condor 64:471-472, fig. 1.

Wilkinson, H.E. 1969. Description of an Upper Miocene albatross from Beaumaris, Victoria, Australia, and a review of fossil Mem. National Mus. Victoria vol. 29(4), p. 42, pl. 3, fig. 2, pl. 4, figs. 2, 5

Wilkinson, H.E. 1969/ Description of an Upper Miocene albatross from Beaumaris, Victoria, Australia, and a review of fossil Diomedidae. Memoirs National Mus. of Victoria 29, pp. 41-51, pls 3-4.

	exulans	16468
Humerus distal from Shearwater 1625		
Prox. dist end	31.6	27.5
Ratio prox/Rec.		87.2%
Prox ratio on spec.		
54544 above	48.5	39.2
Ratio above (dist)	14.4	11.7
Ratio br. dist to prox.	65.3%	70.3%

4.28.74

Family Diomedidae

Three fragmentary elements (distal tibiotarsus no. 37629, ⁶⁹⁰²proximal humerus no. 54544 and distal radius no. 31172) represent an albatross larger in size than Diomedea albatrus and D. nigripes, but smaller than D. exulans. These elements have not been identified in the four fossil species of Diomedea previously described, namely: D. anglica Lydekker, D. californica, ⁶⁹⁰²D. milleri Howard and D. thryidata Wilkinson). It is, therefore, impossible to make a definite assignment of the present material.

On the basis of size, agreement is probably closest to D. californica. However, the tibiotarsus, compared to D. exulans, is relatively larger than the type tarsometatarsus of D. californica, whereas the humerus suggests a smaller bird. Possibly more than one species is represented, and/or a new species may be required.

In describing the type distal end of tarsometatarsus of D. californica, Miller (1962) notes that it is equal in shaft diameter but narrower across the trochleae than an adult female D. exulans. Compared to a smaller specimen of D. exulans at hand (LACM no. 230) the tibiotarsus no. 37629 is slightly broader of shaft and ~~xxx~~ ^{very nearly equal in} only slightly narrower in distal breadth (See table). The humerus, however, is not only considerably narrower proximally than in D. exulans, but is markedly shorter from head to distal end of deltoid crest (see table).

Regarding Wilkinson's suggestion that D. calif. may belong instead to the genus Maronites. The decision in this regard will ~~probably rest with the tarsometatarsus~~ ^{be restated}. With regard to the humerus now at hand, however, if indeed it does represent Miller's species, there is no doubt that the genus is Diomedea & not Maronites. Comparisons with typical Hydrobatid

41440
check prox tarsus
Shank with three for 1655
Trochleae ^{very} delicate in Maronites
2 grooves well developed Maronites
1 groove Diomedea & center part of hypotarsus wide & almost flat

LACM exulans prox br. 22.3 = 790 smaller than Miller's
Miller " " 23.9 93 x 8.0 ch. (LACM 230)
1655 br, sh 8.4 = 790 less than type
Type calif. 9.0

41440
make 8.4 x 6.5 = 77.290
Shape
D. calif. with 9.0 depth 7.9 = 87.990
7.5 x 6.7 = 89.290
Miller's exulans 9.4 x 8.2 = 88.390

copied

Keep for future reference

In view of Wilkinson's (1969) suggestion that *Diomedea californica* might possibly belong to *Macronectes* rather than to *Diomedea* it may be noted that another ~~incomplete~~ tarsometatarsus has been found at Sharktooth Hill bonebed (type locality for *D. californica*) which has the ~~the size range possible for the species D. californica~~ ~~characteristics~~ hypotarsal characteristics of *Diomedea*. hypotarsus broad, almost flat toward external side with a single deep groove between this and the internal calcaneal ridge. Dr. Pierce Brodkorb has kindly checked these characters with his specimen of *Macronectes* and finds them to be distinctive of *Diomedea* rather than *Macronectes*.

In view of Wilkinson's suggestion that *Diomedea californica* might possibly belong to *Macronectes* rather than to *Diomedea*, it is worthy of note, here, that another tarsometatarsus has been found at Sharktooth Hill bonebed (type locality of *D. californica*). Although the distal end of this specimen is lacking, the shaft dimensions are within the range possible for *D. californica*. The proximal end shows the typical ~~Diomedea~~ hypotarsal characters of *Diomedea*: hypotarsus broad, almost flat toward external side with a single deep groove between this and the internal calcaneal ridge. Dr. Pierce Brodkorb has kindly checked these characters with his specimens in his collection (which includes *Macronectes*) and finds them to conform to *Diomedea* rather than to *Macronectes*.

The humerus now at hand also is clearly *Diomedea*id, ^{not Hydrobatid} The anconal area below the head is broadly rounded (no median ridge), the ~~osseous~~ ^{osseous} fossa below the internal ligamental furrow ((on palmar face) is shallow. Again these comparisons have been kindly verified for me by Dr. Brodkorb.

Check distal tarsus to *Macronectes* when specimens come from Pierce.

Thyrdata rostrum NMV. P24172 est. bill length 100-105 mm
(length we is 68.5)
length of rostrum is 70% of culmen
max. width 19.5 (altered) probably 22 mm in life
HT 26.2 mm. (negative 25.5-26.3)
width culmen ridge 8.1 ant. to nares
bill itself at this point is 15.8 mm

Gr. exulans given 40.5 max
ht " " 38.3
width
culmen ridge " " 17.4
Bill width
same place " " 30.1

59.6 Length 390
41.6 max. Bill
LACM 1268
(152.5 max 569)

(max 27-28)

1969 (p. 47)
Wilkinson states that his sp. *D. thyridata*, is related to
the "*D. melanophris* group" in distinction to the "*D. exulans*
Melanophris"

Group which includes *D. albatrus* & *D. nigripes* specimens
of which are all at hand for comparison with LACM 37429

fnr dnt
48.5 } 31.626570 *humus exulans*

39.2

254? dnt *albatrus?*

Salidae

Niguel

Protr. 73568 ~~Phalacrocorax~~? = Sulid (Mussula?)

21.9 - br. hump (15.7 ^{auth} albociliatus)

22.2 br. hump (13.3 ")

15.2 ~~br. hump~~ ^{nasals} ~~br. hump~~ ^{at} (9.4 ^u albociliatus)

15.45 depth

Very marked groove sep. nasals & ~~br. hump~~

No pectoral ~~fin~~ in part of hump or nasals
assembles more in two

Nasals narrow & raised above ~~br. hump~~ as in
common

Palatal side ^{maxilla} palatines prominent - raised ^{rounded} as in Sulids
(Phalacro. they are flat)

Palate depressed medially as
in rasta referred to M. magnus & longicauda

also deep lateral grooves as in those species &
moderately S. dactyl & M. Gars.

Length 74mm to broken tip from hump
possibly another 40mm.

Fossil Solids lengths (many estimates because of slab condition)

	Tarsus	Tibia	Femur	Humerus	Ulna	Carpometacarpals	Skull	Coracoid
S. willkelti								
✓ Type (Pub)	41.0	71.0	52.0	156.0	147.0	70.0	64.390	45
✓ Reverse of type ^{25/42}	43-45	69.0	52.5	155.5 (152.5?)	144.9 (146.4)	69.3 (67.5)	—	—
✓ #2839 Lompo ^{8/8}	43-44	71.8 78.4-79.3	56.2?	173 (180)	—	63.7	78.6 (133.7?)	—
✓ #2843 Lompo (ident?)	41 (42?)	? 70.3-73.7?	47.0?	149.1	150-152	68.8-73.2	—	—
Aligato Pini spec.	45.3	80.5	57.3	—	—	—	—	—
S. lompoana								
Type (Pub)	—	—	69.0	245.0	180+ (cast)	—	—	25.320 62
#2838 (figd) PL7	59.6 (53.6)	92.3 (94.5)	63.0 69 (70.8)	—	—	—	—	—
#2840 ident?	55.6 (59.5?)	106.5 (104.6)	65.0 (65.7)	248?	184? (184?)	—	95.6, 147? inc	—
✓ Specimen on Plate 9	60-63.2	166.3	74-76	229	202.4	96.6	70.4?	27.1?
2836 Reverse of type	—	—	71.1 ap.	250?	—	—	83.9, 140	66.5 with cast 60.0 66.6
Miosulamida								
✓ Type (Pub)	64.0	—	—	180.0	140.0 (135.0)	81.0	—	—
Reverse of type ^{or cast} 2799	✓ 63.0	89.0 (90.1)	—	✓ 183.0 (190)	✓ 139.2 (138.6)	✓ 81.4 (79.8)	84.290?	32.8? ^{✓ ap. 80} with 3.4
Morus magna	65.5?	—	—	225. + (250?)	—	116.1	—	—
Sula pahl								
Type	—	—	—	145-150.5	170-172	69.3	79.490	33-34? ^{axial} 55.0
Pelionula strackii								
Type	—	—	—	264	175	102	—	—
referred humerus	—	—	—	247-252	—	—	—	—
Sula pygmaea	—	—	—	—	—	81	—	—
Sula gravis (pub)	—	—	—	—	—	—	—	50
Morus pinnulatus/pub	—	—	—	—	—	—	—	54-55.6
Sula arista	—	—	—	—	—	60	—	—
#5001 Encino	66+	107-109	67-69	218-222	—	—	—	—

Sulids

smallest
Loc. 1945

low
6906

loc. 1945
large

low
6902

W. T. M. S.
S. aurka

M. brachyura

Shankh shell

S. S. S.

Sandbags

Miller meas.
Wilke's

Longman
M. S. S.

Humerus

Length

Br. distal end

15.3

26.7

15.2 (9.7)

21.1 (9.1)

18.5 (5.1)

15.6

28 hnd

24.5

180

Ulna Length

" " heat

Carpometacarpus

Length (ext) 96.7

116.0

Depth M1 (int)

?

17.5

94.7

Wt M1 (ext)

16.1

11.3 (or ?)

64.6 ext
14.7 ext
8.9 ext

Scapula

Length

T. Iliac spurs depth

Length

Br. dist

Tarsometatarsus

Length

Br. prox

Br. dist

Coracoid

Length (vertical)

" (int, angle)

Br. at scap facet

Humerus " head

Quadrato

Length (gr)

Br. (least)

Cuneiform

32431
32428 6906
12.9
8.5
17.5
12.2
20.7

13.4 ap 7
9.9

16.7
23.9

20.8 close to (numbers)
4.7 dark stain
12.4 close to dark stain
6.4 mm. liban

12.9 and 13.9

55

73.6

20.4

26.1

41-43

45

53.6-59.5
13.8

16.3

62

64
13.5

17.6

74.0

Large Solid *Rostium* n.sp.
ref. to m. magnus

3, 25, 76

Rostium unnumbered from 6902
now 77494

PECKECK *Willitti*
type ♀ #2840, 2835, 2839
longicauda *Willitti*

A 34.7 - br. across hinge measure of type *Willitti* = 24.3 mm

B 25.5 - 81. depth

C 31.4 - br. premax, at level of end of groove

D₁ 60 mm from level of end of groove
D₂ 70 mm from hinge premax narrow to 11.6
D₃ br. maxillae at same place 15.9
Depth here is 12.3

Total length 93.7 but tip broken

(Probably another 28 mm to tip)

could be 119.4 - 121.7

93.7
+ 28
121.7?

Rostium 37614 from 6906 assigned to *longicauda*

25%
smaller
than
the one
from 6902

A 24.1? probably ant. to hinge
B ~~20.0~~
C ~~22.3~~

95.1 *longicauda*?
93.9 Total length of specimen (almost to tip)
hinge to tip same as in *dactylota*

dactylota A 24.6

carpus length 88.9 (Bassanus 90.9)
ap. 25% less than
carpus 37632
(76.390g)
#2 6906 95.8
assigned to *longicauda*
→ 93.70g ↑

ap. 22%
less than
found from 6902
78% of
93.90g

37614 from 6906 B 19.4
Fossil 116.1 carpinata. 37632 from 6906

prox end radius

sh. 5.9 br. = *Bassanus*

prox end cart br. mea

	(<i>Bassanus</i> → 3095 16291)	<i>dactylota</i> 1334	<i>websteri</i> 1339	<i>donaldi</i> 37674	<i>gigantus</i> 6902
A	25.4 premax 26.7 gr. br. premax (Chelidon 25.1)	24.4	23.0	23.9	34.7 br. hinge 3.4 basal 30.8 premax
B	15.4	20.4	15.7	18.9	25.4
C		21.4	19.0	23.7	
Length D	106.6	93.2	78.6	95.1 <i>dactylota</i> + 3.7? 108.8?	121.6?
distal premax	21.3	22.2	21.7	23.9	31.4
	28.0	21.2	18.7	23.4 <i>carpal</i>	30.7

being in our case with some pieces, bone in place)
~~In view of the fact that the five species of similar age~~
 are all based on impressions in slates & shale.
 The identification of these ~~bone fragments~~
 is difficult. H. H. J. H.

With one exception all the Late Miocene species are ~~known~~ based
 on skeletal impressions in slates & shale. In the one exception sp
 (S. publi) fragmentary bone remains in some of the impressions
 but reveals no detailed characters, ~~though~~ ^{possibly} to a further
 very difficult to make ~~and~~ ^{an} ~~idea~~ ^{idea} of the bones of
 the same age now at hand. ~~Only~~ ^{the} chief distinguishing
 character of the previously described sp. is ~~the~~ length of
 individual elements and proportions of one element to another.
 Unfortunately only 3 of the bones now at hand (all
 carpo-metacarpals) are complete. On the basis of ~~these~~
~~two~~ ^{three} of these (of similar length) are assigned to
 M. longicaudus, the third is markedly larger than any
 heretofore described ~~and~~ ^{is} named as new.

Genus Carpo-metacarpus

The two carpo-metacarpals nos.
 meas. 94.7 and 96.7 mm in length respectively. The type
 of longicaudus does not ^{possess} have this element, but a second
 specimen illustrated by Miller (1925, pl. 9) does.

	carpal plate	met plate	total length
Humerus 32430	10.5 x 5.1	9.4 x 4.2	—
Length ant. art. lig. attach sp. to distal	29.2	24.1	—
Depth ext	16.9	14.4	—
Depth int	12.5	11.2	—
Depth from dist. process above proximal joint	28.3	30.3	25.5 or 29.0
Depth middle carpal	10.3	8.5	—
Length above attach int. ext. cond. process	22.8	17.0	—
Int. ext. cond. process above dist.	15.7	12.1	—
Ext. cond. process	21.8	17.5	—

prob. tarsus on model of type m. ^{longicaudus}
 appears to be 12.5 + 12.8?
 H. 42057 12.8
 12 32428 12.7

— lower leg, tip of met. (left & right)
 high leg, gr. b.

Ext. process ulna # 52748 - 6.3 dist
 3.8 at -
 42684 6.3 dist
 39 sh

6/11 4000 809 07.94.2

Hummer

22.5 br. dist. humer. p. 840 Comp. 23.9
 28.8 br. p. 11 11 11
 25.3 " " me. " type cast comp.
 29.2 " p. 11 " " " "

Barraun 23.9
 Barraun 31.5

fever 37628

37628 barraun
 heart br. sh 8.9 7.5
 gr. br. dist. end 15.9
 br. abn. dist. end 13.7 10.3
 br. dist. end ant. h. 14.2
 depth mid. h. 9.4 7.5
 5185 52217

#37633

Donna

7.0 7.0?
 16.0
 10.3 10.4?
 13.9 13.9

137 270
 123 370
 370
 123 370
 123 370
 123 370

Tibia type *Muscula recutina*

Length 112.5 114.0 (pub. 114.0)
 X br. dist. end 11.8
 br. dist. ant. 13.8
 gr. br. " 14.4
 depth ext. end 11.3
 " int. " 13.4
 y " dist. end 13.0
 calc. flat (posterior)
 br. sh. below 7.3
 depth humer. 4.3
 br. sh. dist. at dist. end 11.0

11.25

13.7

13.8

10.9

12.9

12.7

8.0

5.5

10.8

Sh. below

barraun?

11.1

12

12.5

10.0

11.9

12.2

7.5

4.7

10.1

98.7 (98.5?)

11.4

12.7

13.0

10.7

12.0

11.7

7.5

3.25

4.7

M. recutina more thrust to int. side & int. condyle slants so that prox. tip is more medial than dist. edge. Ext. condyle also slants (prox. tip points laterally not directly prox. tip)
 Both condyles more straight in Sula; ext. has slight lateral slant but int. is straight - ~~as in~~
 in M. recutina. Both fossils are like M. recutina, 52217 differs from M. recutina (Sula in having br. dist. slightly tilted toward shaft (pat.) at its upper edge (not so vertical) true abn. 52230 & 9 Muscula recutina type
 In M. recutina type of int. condyle is slightly lateral to the edge of the shaft, not ~~slanted~~ slanted medially as in Muscula recutina

Wln 37636 deep pneumatic foramen at
6902
caudal tubercle as in *Morus lucinus*, none in *Sala* sp.
the pneumatic foramen that occurs adjacent to
the ext. crest of the trochlea in *Morus* & *Sala*
does not show (perhaps needs cleaning?) assigned *M. longicauda* 1974

Conformata ⁷⁷⁶⁹⁷ ~~1974~~ has deep pneumatic slit. like *foramen*
ant. & just far piece both ext. & int.
deeper than in any ^{recent} although all have small holes
Length 25.7, ht M1 - 12 mm br. sh. 10.5 - depth ext 18, 8 then M1
Th. br. mid 7.7 " int 19.9 " "

m. new species *m. magnus* 1974
Carpo, 37632 also has deep slit ext & depression
4906-9 with 2 small holes int.
ht M1, 15.9, length 116.2, br. sh 10.0

Carbonellacus 37032 - Type n. sp. Morris.
6906-#6 called by Marion S. Bohrer 1969

Puffin hawaii 42032 - type n. sp.
6906-N called by Earl Calhoun July 1969

Puff. n. sp.? ulua 5'2748
7136 Michael K. Hammer 1970

Gavia ulua 31173 (left ulua type n. sp.)
6904 G called by M. S. Bohrer 1969

Diomedea tibic large
6906 #6 Marion S. Bohrer 1969

Diomedea tibic frag. smaller
6906 W. Earl Calhoun '69 or '70

Loc. 0902 Sulidae

Californiacanthus 37434 M. lomporana

Miguel (Miocene)

Clearly shows pneumatic orifices on ant side below
int. trachea + post. to pinniform process as in
Sula + Morus today.

[Unfortunately the very large calpo. # 37632 from
loc 6906 - G₂ to inc. in this area tho it
is depressed + suggests a small crifing it does
humera have a deep ^{slit-like} depression on ext side
at junction of M1 to carpus as in Morus]

# 37634	# 37632	M. lomporana	M. lomporana	M. lomporana
G ₁ length	94.7	115.8	96.6	90.1
br. sh	7.9	9.6		7.4
int below middle				9.9
br trachea	10.6	inc 11.7		
ht M1		16.35		12.4
(prox-dist. from joint to tip)		broken away		

Humerus 32430 loc. 6906 new species M. magnus 1976

Br. distend. 29.2 mm (S. lomporana, Pl 9 Miller 1925, 23.5; Cassin 23.9
M. ~~lomporana~~ vagabundus Shauhin 1968
(unrec'd) meas. 20.4, ~~another spec~~ = 15.9
Morusoxystyla 21.1 (Wetmore, 1930:91)
M. lomporana UCLA 2540 unrec'd 22.7)

Coracoid length

Morus medius
cont. of type
int angle - 73.4

M. lomporana
cont. of type
int. 60.0

M. lomporana
Pl. 9 UCLA
int. 66.5

22
13

20.6
4) 106.5
86.5
20.0
26.5

33
3) 106.5
99.5
7
1

106.5
24.3
32.2

26.6
3
79.8

Length of fragment 54.1 mm.

A rostrum (no. 73545 from ex. 6902) resembles the commonants dorsally in deep labial groove setting off the narrow nasal process from the maxillae + premaxillae below. ~~The rostrum does not resemble the species, however, as it is straighter than the straightly & the evenly sloped dorsal profile resemblance is close to P. penn. than to P. auro.~~ However the specimen is 21.8 to (17.7 at bridge) (18.3 carbo) 14.5-16.5 auro + 25.4 m. bass. (21.7 Sula leucogaster) (24.9 dactyl.)

Br. max. (posterior part) 21.9; 14.0 penn., 12.3-13.2 auro, 14.0 carbo, 11.5 dactyl.

Depth 14.4 (post. three max. palatals); 8.1 penn. (max. pal. not visible), 8.7 carbo, 7.0-8.0 auro + 16. Sula leucogaster, 15.4 mous, 17.6 dactyl.

Br. nasal proc. 15.3 (at end of groove) 8.2 penn., 8.5 carbo, 9.0-6.4 auro, 18.3 mous, 18.0 leucog.

markedly larger than many of these species, equals m. bassanus in breadth at the fronto-nasal bridge.

In palatal view resemblance to the commonant is less visible, and in the swollen max. hypopalates with deep groove centrally & laterally more closely resembles the sulids. The turbinal area is perforated than in the sulids. Though the turbinal area is slants smoothly upwards from the central groove and seems even less perforated than in Phalacrocorax. The lateral openings at the ^{posterior} notch between the nasals + maxilla are not only actually as well as relatively smaller than in any of the commonants. The distance from this notch to the hinge is rel. less (13.3) 14.7-12.5 auro, 13.5 penn., 12.5 carbo 13.6 mous, 12.5 leucog. + dactyl. The area is very prominent in Sula + mous but resembles the form in the reduction of the opening part to the notch. The rise from the ^{maxilla} roof of the palates to the hinge is relatively less than in Phalacrocorax + more much resembles mous.

Measurements of Rostra (in mm)

No. 73565

M. bassanus

S. ~~leucogaster~~ *P. fuscillata*

P. carbo

Br. at hinge	21.8 ✓	25.4 ✓	21.7 ✓	17.7	18.3 ✓
gr. br. ^{maxilla} maxillae	22.3 ✓	25.1	19.5	14.0	14.0
Br. nasal process (at posterior end of grooves)	15.3 ✓	18.3 ✓	18.0 ✓	7.7	8.5 ✓
Gr. depth	✓ 14.4	15.4 ✓	16.0 ✓	8.2	8.7 ✓
Ratio br. nasals to br. maxillae	68.6%	72.1%	83.0%	55.0%	46.3%
Ratio br. hinge to br. maxillae	98.0	98.7	89.6	79.2%	76.5
Ratio depth to ^{gr} br. maxillae	64.5 65.2	61.4	92.3	58.6%	62.2
Ratio br. nasals to br. hinge	70.2	72.2	83.2	43.6%	46.5
distance from roof of palate to tip	17.6	18.2	18.2	18.5	
Ratio br nasals to depth	106.2	118.8	112.2	94	97.8

over

Copied

Sulidae sps.

Two rostra (no. 73565 from locality 6902 and ^{no.} 37614 from locality 6906) are smaller than the specimen referred to M. magnus.

No. 73565 bears strong resemblance to the cormorants in dorsal aspect, having deep lateral grooves setting off a narrow nasal process from the maxillae and premaxillae below. There are, however, no dorsal foramina such as occur in Phalacrocorax. In palatal view, the ~~maxillopalatines~~ ^{not bear} resemblance is closer to the sulids: the maxillopalatines are swollen and are bordered laterally with wide, deep grooves. The turbinal area ~~slats~~ ^{is} smoothly upwards from the central ~~resembling in this regard Phalarocorax and Morus~~ ^{resembling in this regard Phalarocorax and Morus} groove between the maxillopalatines and bears very little perforation. The lateral pneumatic openings are much reduced in comparison to those found in the cormorants, ^{however,} and compare more favorably with those of Morus. The turbinal area is more perforated in Sula. The rise from the maxillae at the roof of the palate to the fronto-nasal hinge is ^{relative short as} similar to the condition found in the sulids, ^{this area is} the rise is relatively longer in the cormorants.

In view of the fact that Miller noted certain characteristics of Miosula ^{medium} that were cormorant-like, the possibility that this rostrum may represent Miosula is ~~certainly~~ suggested.

The second rostrum (no. 37614) is typically sulid in ^{all aspects} conformation. It is ^{more massive} heavier than no. 73565 and possibly represents Morus lomocanus.

over

For reference only
Dinner was table

	Solid Measurements XXXX Elements (re: M. lompopocanus)			
	M. bassanus	M. lompopocanus	Paleosula M. stocktoni	Miosula media niguel
Carpometacarpus				measured on renewed type
Greatest length	90.0	96.6	102	81 (note fault) 94.7-96.7
Height process M1	11.5			12
Greatest depth proximal end	20.1			19.9
Breadth proxi- mal trochlea	9.9			10.5
Breadth middle of shaft	7.4			7.7
Ulna				
Breadth distal trochlea	10.4			10.5
Shaft dimen- sions	9.3 x 8.2			10.2 x 8.5
Tibiotarsus				
Breadth distal end (greatest)	13.0 ^{OK}	13.0/	13.7 ^{OK}	13.8 ^{OK}
Depth distal end	11.7 ^{OK}	12.5?		12.4 x 7 ^{OK}
Breadth shaft	7.5			8.0
Depth shaft	5.25 ^{OK}			5.5 ^{OK}
Femur				
Breadth distal end (gr.)	15.9	15.35?		16.0
Breadth dist. (taken ant'ly)	14.2	13.9 type lompopocanus		13.9
Breadth shaft	7.5	7.0		7.0
Depth shaft	7.5			7.9
Rostrum				
Greatest br. at hinge	26-27			24, 1
Depth gr.	15-14			20, 0
Est. length	101-106			95+
Radius				
Br. sh.	5.9			5.9
Tarsometatarsus				
Br. prox end	12.9	12.9	12.8-13.5	14.1 17.6
Br. shaft	8.9	9.0	8.7	10.0 dist 11.0
Depth	9.6	10.2		10.9
Br. dist	17.9	16.3		17.4 17.7
	br. dist. 9.2			

Morus lompocanus

Two carpometacarpi (no. 37634 from locality 6902 and no. 37637 from locality 6901) are assigned to this species on the basis of similarity of size and age. This element is not present in the type of M. lompocanus, but can be measured on a second specimen assigned to the species and illustrated by Miller (1925, plate 9).
Measurements: ^{Length} no. 37634, 94.7 mm, no. 37637, 96.7 mm, M. lompocanus 96.6 mm, Paleosula stocktoni 102 mm, Miosula media 81 mm, Sula will-etti 70 mm, S. pohli 69 mm. Measurements of this element are not available for the other Trochilidae, but judge from the element known as Sula that M. lompocanus is the only Trochilidae in the Stockton locality.

Three other fragmentary elements conform in size with comparable portions of the same elements of M. lompocanus: distal end of ulna no. 37637 (locality 6902), distal end of tibiotarsus no. 52217 (locality 3185), distal end of femur no. 37628 (locality 6906).

A few qualitative characters observed in comparison with Morus bassanus may be of value in identifying future occurrences: Carpometacarpus with deep, slit-like pneumatic foramen proximally anterior to the pisiform process internally and in a similar position externally; deeper than in any Recent species of Morus or Sula compared. Ulna resembles Morus in the pneumaticity of the palmar face of the carpal process and the size of the process. Tibiotarsus with tendinal bridge less verticla in position than in modern species, the upper edge being tipped posteriorly; this is true, as well of the type tibiotarsus of Miosula recentior, but the latter is distinguished from the specimen now at hand by less vertically oriented condyles (the internal condyle slants so that its proximal tip is more mediad than its distal end; and the external condyle slants so that its proximal tip points laterally); the specimen from Laguna Niguel resembles modern Morus in more vertical position, though external has slight lateral slant (both are straight in Sula). It should be noted that the tibiotarsus no. 17570 from the another Orange County site of Late Miocene age (locality 1945) was previously assigned to M. lompocanus (Howard, 1968) matches the present one now at hand in these characters.

Measurements: Carpometacarpus no. 37634, height of process of M1, 12 mm, depth proximal end through process of M1 internally 19.9, externally 18.8; breadth proximal trochlea 10.5 mm, breadth middle of shaft 7.7 mm. Ulna, breadth distal trochlea 10.5 mm, shaft dimensions 10.2 x 8.5 mm. Tibiotarsus, breadth of condyles 13.7 mm, depth through internal condyle 12.7 mm, dimensions of shaft above fibular crest 8.0 (breadth) x 5.3 (depth).

Tarsus Sulids

Sula has shorter middle toe than has Mous

17.6	324 31	dist	X 11.6	shaft inc. length	53.9 at least 4.5 more
12.5	bassanus	X 8.65	"	int length	54.7 to cotyle
16.4	dactylah	X 10.6	"		
14.65	bassanus	pub	X 11	shaft at papilla	109.00 mm int. 12.5 h. the ext calc. may
12.9	324 28		8.9	"	" 19.6 depth the int. calc. ridge
12.9	424 57		9.0	"	" 10.2 depth ^{upper} int. calc. ridge

int. length 61.6 mold of Muscula media

humb near. of S. willardi - various specimens									
	type	obverse	2835	2839	2843	type	2843	2843	2843
Length humerus	156	153	none	180+	149	24	229	202	none
Length ulna	147	146+	—	none	150-152?	none	96.6	none	none
Length carpus	70	69.5	none	none	68.8	none	63.2	59.5	53.4
Length tarsus	41	43	none	43.0	none	none	106.3	109.4	94.5
Length tibia	71	69.5	none	77.8	none	69	74	56.7?	70.8
Length femur	52	52	none	none	none	71, calc.	none	144.9	none
Length skull	129	—?	142	133.7	none	none	none	140?	none
Length mandible	114	—?	138.5	131.4	none	none	66.5	none	none
Length crassid	45	—?	none	none	none	62	66.5	none	none

	Misulamedia assiguita P. stocktoni	Pal. stubbini	unidentified P. g. near M. longicauda as given with Stocktoni	Del. (adults) Wulff Sula	Sula noblei	skull with 7432 (tele) Morus vapabudus	skull 116.5 115.8 117.8 117.1 117.1 117.1
Length humerus	181	264 pub	277	none	170	170	116.5
" ulna	140	175.0 pub	201	45.3	69.3	69.3	115.8
" carpus	85	102 pub	93	80.5	none	none	117.8
Length tarsus	90.8	none	none	57.3	55	55	117.1
" tibia	90.8	none	none	57.3	55	55	117.1
" femur	90.8	none	none	57.3	55	55	117.1
Length crassid	90.8	none	none	57.3	55	55	117.1
Length tarsus	90.8	none	none	57.3	55	55	117.1

Humerus broader prox'ly than distally in Morus et al

Sulidae

3,2576

Fulidae

Muss. bassanus 90.5 20
Sula 89.8 - 93.8 20

Dist Tiliaprom 31.85 # 52217

6902 # 57834 fto shaft 53908
dist

Bath = morus rather than Zula on basis of rel. of depth of dist end

94.8% 12.55 x 12 - bassanus

89.8% 13.8 x 12.4 - dactylata

92.2% # 1352 11.5 x 10.6 - leucogaster; # 251 11.4 x 10.7; 1349, 9.6 x 9.8

96.9% m. 6902 fto 11.9 x 11.4 - # 57834 (3990 of larger Camerupter m. only 82.5% of max)

90.6% m. 3155 fto 13.7 x 12.4 - # 52217

94.0% m. 1945 fto 13.3 x 12.5 - # 17570 from 12/945 assigned leucogaster to leucogaster

86.5% m. 6512 fto 11.9 x 10.3 - # 31631 " 20.45121

91.6% m. 253 - 10.9 x 10.0 Nelsoni; # 1339, 11.1 x 9.5

6902 fto 57834 ext. bond 10.9, int 12.0 83.5% lay the from dist end to proximal end
3155 " 52217 11.1 12.7 82.4% dist tip of fibular crest
1945 " 17550 11.1 13.0 85.5%

bassanus 18173 10.8

Nelsoni 1339 8.0

Nelsoni 253 8.4

dactylata 1356 9.8

leucogaster 251 7.9

" 1349 7.1

" 1353 8.5

12.1 89.2%

10.1 79.3%

10.6 81.2%

13.3 73.6%

10.0 79.6%

5.9 79.9%

11.2 75.5%

8 x 5.3 ft to depth shaft # 52217

above dist. portion of fibular crest

7.6 x 4.8 ft to depth shaft

same place in # 57834

7.4 x 5.3 in bassanus

7.9 x 5.3 dactylata

Tendulal bridge tips posteriorly at its proximal end contracted with all other sulids where it is straight across (more vertical); bridge is flatter as in bassanus; tends to be more bowed in Sula

Carponcha. even more depressed below prox. form than in bassanus

Sula inflated

95.5 prox. length, 90. bassanus

la 6901

large carpus above like bassanus in area below proximal length 114.1 mm

12.8
90 116
90
200
150
500
250
500

Possibly *M. lombricatus*

Size OK

Ulna 37634/6902

7 dia 57834/6902

" 52217/3185

Premax 37614/6906

Carpus 37634/6902

" ? / 6901

Femur 37633/6902

Radius 58551/6902

int. depth dist end 11.9 mm, (Müller pg 9 *M. lombricatus*
int. depth dist end 12.5)
(miswritten? (int. depth dist end = 12.5 mm for 13.7

Specimen from Loc 1945 same
int. meas. 13.7 mm

ext. dist 11.2 mm

h. dist 13.5

Micromys media measured
on lateral molar
h. dist 12.2

	h. dist	ext. dist	int. dist
lateral - <i>M. media</i>	12.2	11.9	12.4
57834	12.0	11.9	12.4
52217	13.7	12.4	12.4
<i>M. lombricatus</i>	13.7	12.5	12.4
Loc 1945 17570	13.5	13.5	11.2

Nigel
Julidas

	Lag. Nigral	M. lomp.	Micula media recuta	M. banan
Carpometa	37634 46402 27,0901	96.6	81	90.0
Length	99.7			9.9
br. tal	10.6			7.4
br. tal mid.	7.9			11.5
Tibial	16.1	?		
dist. breadth	13.7		13.7 14.0	13.0
" depth			10.0 11.3	10.7
depth ant. cond.	11.1			12.1
depth int. cond.	12.7			
Tarsometatarsus	42657 12.2 32428?	13.84	14.1	14.4
Prox br.	12.6-12.8			9.8 where?
br. sh.	42657 4.0 6.5-6.9?	8.7?	8.2	mid?
dist.	11.1 17580 17.1 32431 sh. 9.17.6 1.2		17.0	
Ulna	37434			10.4
br. trochlea	10.5			9.3 x 8.2
shaft	10.2 x 8.5			
Tarsus contra				
length	est. 42657 prox	54.6-63.2	64.0	
	est 17580 dist.			

Sulidae

Alcidae

Niguel

Note shape of pectoral attachment
broader & more medially at prox. end in *Lunda*, touching deepest part of
head.

In *Cerithium* deepest part of head is distinct from pectoral crest
with space between. Pect. scar is rather even & small.

By *Lateralis* is inserted bet. *Lunda* & *Cerithium*
having ~~the~~ a more uneven scar than *Cerithium*
but less extended than *Lunda*. It does not finish the
deepest part of the head however - there is also *Cerithium*

537	524	491	26	5696	<i>Lateralis</i>	Series # 42458
<i>Cerithium</i>				<i>Lunda</i>		
13.2	12.1	12.8	13.4	14.3	17.9	149 head to end of cephalopod
12.6	11.7	12.3	12.4	14.3	13.6	160 delta (only) not to head
11.1	10.0	10.65	10.7	12.0	10.9	12.0 head to pectoral

<i>Anchithea</i>	31-II-B
head to back	15.6
delta	15.0
head to pectoral	13.0
to pect.	

C. dubia tibia is 95% of length of mean C. monovata
 91% " " " max " "
 101% " " " min " "
 tarsus is 99.0% " " mean " "
 94.8% " " max " "
 104.6% " " min " "

37638 dist. humerus is 111.2% of breadth of mean C. monovata
 (Loc 6902) 102.7% " " max C. monovata
 116.0% " " min " "

42658 prox. humerus (Loc 7136) is 117.5% of prox. 6. med. ant. third feet mean of C. monovata
 110.3% " " max " "
 123.6% " " min " "
 Same bone (42658)'s of br. head (int.) to ext. tub. mean " "
 113.2 " " max " "
 106.2 " " min " "
 121.2 " " " " "

Ratio tibia to humerus

20 - 92.5% } C. monovata
 991 - 93.1
 524 - 90.7
 535 - 94.0

696 - 96.2 *Synsira cinctata*
 661 - 96.4 *Latiscala conicatus*

Ratio tarsus to humerus

44.3 -
 44.2
 43.6
 43.6
 42.6
 43.4

Tarsus of C. dubia @ 29 should have humerus 66.5 - 65.6 long which is close to C. monovata
 Tibia of C. dubia @ 60 should have humerus 64 - 66.3 long

Modiolus Carolinensis monaculata

#20 tibia	62.2	491	61.8
tarsus	29.8		29.2
humerus	7.2		7.4
a. dist. b.			
b. humerus	9.7		9.9
c. depth			
c. depth	8.0		7.9
d. h. depth	8.3		7.94
d.2 " "	5.9		6.3
carpo.	36.9		36.8
ht. MP. carpo.	6.2+		5.8
height rad.	51.3		51.7
g. humerus			
depth b. car.	5.3 x 3.2		5.8 x 3.2

C monaculata		Ratio br. Chest to
Length humerus		ext. hum. to length hum. (g)
#20	67.0	15.820
491	66.3	16.3
524	65.3	16.7
537	70.2	15.6
Lunda	72.9.5	
696	78.2	17.5500
Fract.		
661	69.6	15.8900
Lunda		
arch. hum.		
31-10-C	80.1	
31-11-B	76.2	
31-12-1	73.9	
31-13-B	72.4	
31-14-E	72.1	
31-15-E	78.8	
31-16-2	68.6 (Carinica?)	

42658 on this
 bands could be length
 of
 77.0 - 72.0 mm
 (within Lunda carinata size)

42658	pro. humerus	br x depth sh	67.70
37638	dist "	" "	59.90 ✓
Pomfoc	pro. end sh	" "	66.90
"	dist "	" "	60.90 ✓
(C monaculata pro)	" "	" "	67-73.90
Lunda	" "	" "	68
Fract.	" "	" "	69
C monaculata dist.	br/depth		53.4 - 60.0 90 ✓
Lunda			59 ✓
Fract.			61.9 ✓

7. *Cephus* sp. compared later
 ?*Miocepheus moolungi*?
~~XXXXXXXXXX~~ + dist condyle not M. moolungi

The proximal end of ulna (no. 47045) from locality 6906 represents a larger species than the humerus just discussed. It resembles the genus *Cephus* in the more rounded, less keellike shaft than is characteristic of *Uria*, and most other alcids.

It is distinguished from *Cephus columba*, however in (1) more prominent attachment for the anterior articular ligament, which is (2) more deeply undercut by the brachial impression; (3) brachial impression wider (extends farther anteriorly (broken internal cotyla possibly accounts for the space below where brachial impression ends) being broader and more squared off proximally); (4) in palmar view, a prominent ridge descends on the shaft below the internal trochlea for a distance of 3.8 mm and appears to be joined at its distal point by a faint ridge running diagonally from the lower edge of the external trochlea (there is a suggestion of this latter diagonal ridge in one specimen of *C. columba* (LACM 1173) (perhaps papillae rather than ridge?))

Measurements: breadth x depth middle of shaft 3.65 x 5 (C. co. 3.2 x 4.4, 3.45 x 5, 3.6 x 5), depth brachial impression vs length of same 3.25 x 14.2 (C. columba 2.4 x 13.6, 2.7 x 14.0, 2.6 x 14.0), proximal breadth 7.4 (inc.), (C. col. 7.0 - 7.3), breadth thru anterior articular ligament attachment diagonally 8.7 (C. co. 8.25, 8.2, 8.12).

More rounded shaft than *Alca torda*, *Uria aalge*, *U. lomvia*, *Synthliboramphus*, *Fratercula*, *Cerorhinca*.

Humerus type of *Miocepheus moolungi* gr. br. shaft 5.5 (C. col. 5.1) least br. sh. 3.3 (C. col. 3.7), breadth condyles 9.0 (C. col. condyles only 7.9), total br. 10.0 (It is difficult to know how the distal b. was taken on the type (whether just condyles or whole end); length of type humerus of *moolungi* 58.2 (columba 67.7).

Wetmore, 1940, Jour Morph., Wetmore 1943, Auk, p. 604 gives meas. of 2nd specimen length 60.1 mm, gr. br. sh mid. 4.8, least br sh. 3.0, br. dist. condyles approx. 8.9.

Miocepheus moolungi described from humerus is also described as being rounded of shaft. The size suggests a bird of about the same size as represented by the ulna at hand.

USNM 25668 *Miocepheus moolungi* humerus from Virginia ref by Storer
 Br. condyles only 7.0, diag. br 9.0
 gr. br. shaft 13.7 length 59.8 (to condyle + head)
 3.2 x 5.6 br x depth shaft middle (57%)
 USNM ulna 237219 M. moolungi from Va. ref by Storer
 42.7 length with from cotyla to trochlea
 br prox 6.6 across cotyla
 3.2 x 4.8 br x depth shaft middle 66%
 2.7 x 12.5 depth x length brachial impression = 22% br x length
 LACM 16322 br 1945 ulna, prox br 7.4 (cotyla) 3.8 x 13.6 depth x length brachial (27.9%)
 4.2 x 8.8 br x depth shaft middle attach ant. art. lig. prominent but
 longer all br. 3.0 x 4.3 br x length than in 47045 from Loc 6906

USNM 25668 *Miocepheus moolungi* type humerus (prox. view)
 3.6 long
 3.4 broad
 3.2 dist condyles 4.0
 3.0 x 4.3 br x depth shaft middle
 2.7 x 12.5 depth x length brachial impression
 4.2 x 8.8 br x depth shaft middle
 42.7 length with from cotyla to trochlea
 13.7 length 59.8 (to condyle + head)
 3.2 x 5.6 br x depth shaft middle (57%)
 3.0 x 4.3 br x length than in 47045 from Loc 6906

Lunda sp.

An incomplete proximal end of humerus (no. 42658 from locality 7136) resembles this element in the puffins. The head overhangs a deep narrow groove; the pectoral attachment broadens proximally and partially spans this groove proximo-externally. The median crest continues almost to the edge of the bicipital crest, in this respect more closely resembling Lunda than Fratercula. Anconally, the apex of the shaft is mediad of the pectoral attachment as in Lunda; in Fratercula it stops at the medial edge of the tip of the attachment. Although it is impossible to reconstruct the contour of the bicipital crest, at least the palmar surface shows a slight inset of the crest from the shaft edge, a condition most closely ~~xx~~ paralleled in Lunda.

Measurements; proximal breadth from external edge to median crest 9.5 mm (8.5 mm in Lunda cirrhata, 8.4 mm in Fratercula conriculata); least breadth of shaft 4.6 mm (Lunda 4.3, Fratercula 4.0), greatest depth of shaft 6.25 mm (Lunda 5.8 mm, Fratercula 5.6 mm).

A distal end of humerus (no. 37638 from locality 6902) also ~~xxxx~~ resembles the humerus of the puffins. The distal end flares slightly anconally as contrasted to the condition in ~~xxxxxxx~~ Uria and Alca in which the distal anconal contour beds palmad. The internal tricipital groove is deep and limited in proximal extent, in this respect closer to Fratercula than to Lunda. The external tricipital crest is ~~xxxxxx~~ ~~xxxxxxx~~ well developed, resembling Lunda more nearly than Fratercula. The external condyle has a clear, sharp border delimiting a definite depression between it and the base of the ectepicondyle as in Fratercula (in Lunda the two areas are not clearly separated. The ligament attachment above the external condyle is broad with pointed proximal contour and the condyle is very little excavated (resembling Lunda).

Medio-distal contour of the bicipital surface is marked with a groove. A groove marks the medial boundary of the bicipital surface & forms an acute angle with the distal contour of the surface as in Certhya. The medial groove occurs in some specimens of Lunda but the distal contour is more rounded.

Alcid 37684 humerus

Distal 5.3 thru. art. lig. ext. condyle (br. al. pygmaea 5

3.7 depth sb above ectepi

2.3 depth " " "

~~dist br. shaft~~

2.4 x 3.3 dimensions at mid shaft

brachial impression

bounded by slight rise^{ext} as in Aethia

ht ectepi 4.9 (a. pygmaea 5.2 H 606299 UCMVZ

Articulation incomplete but gives no evidence of the deep
fucipital groove of Aethia + Cyrtodryas. Art lig. attach
faces palmar more than in (H 18949 from La 1945
is similar a. rossmoori referred but is much smaller

dist br. (taken as above) 4.6 (condyles 4.1 as pub.)

ht ectepi conc. p. 4.3

1.9 x 2.7 above ectepi

1.9 x 2.3 mid sh

$$\begin{array}{r} 82 \\ 23 \overline{) 1904} \\ \underline{46} \\ 144 \\ \underline{138} \\ 64 \end{array}$$

$$\begin{array}{r} 72 \\ 33 \overline{) 240} \\ \underline{231} \\ 90 \end{array}$$

$$\begin{array}{r} 115 \\ 46 \overline{) 530} \\ \underline{46} \\ 70 \\ \underline{70} \\ 0 \end{array}$$

$$\begin{array}{r} 126 \\ 19 \overline{) 240} \\ \underline{19} \\ 50 \\ \underline{38} \\ 120 \\ \underline{119} \\ 11 \end{array}$$

LACM 6906 vic. ~~ulna~~ # 47045

LACM 2906 vic. humerus no. 37684

Alcidae Loc. LACM 6902 distal end humerus no. 37638

LACM 6902 proximal end humerus 52018

LACM 7136 proximal end humerus 42658

Alcidae

Cerorhinca lunda
subulata actua
Cylophryne

The distal end of humerus³⁷⁶³⁸ from LACM Loc. 6902 resembles the Fraterculini (Storer 1958)^{fig 2} in distinction to the Alcini (Storer, op.cit) in the straight anconal contour of the distal end; in the Alcini, the distal end bends palmad. The specimen further resembles the Fraterculini in the angular projection of the ectepicondylar process and the flat brachial impression.

Generic assignment is difficult. the specimen resembles Lunda in the shape of the brachialis impression (broader proximally than distally) and the attachment of the anterior articular ligament (broad at base,, rounding to a point, contrasted to narrower attachment in Fratercula and Cerorhinca). ^{In other characters} ~~Externally~~, however, ~~re~~ resemblance ^{is closer} to Fratercula: ~~is xxxxxx in the sharp edged~~ ectepicondyle, ~~sharp-edged and~~ set apart ~~from~~ at its base from the external condyle by a deep, well-defined cut; anconally the internal tricipital groove is a deep depression, delimited proximally (shallow and of greater proximal extent in Lunda).

The proximal end of humerus⁵²⁰¹⁸ from Loc. 6902 more closely resembles Uria than the puffins in the shape of the ~~external~~ pectoral attachment at the external tuberosity and greater ~~intxxx~~ thrust of head internally. The bone, however, is relatively heavier of shaft than in Uria and on the palmar side, the bicipital furrow is a much deeper groove, and the bicipital surface is more deeply undercut mediad. The bone is badly broken, and the characters are not clearly delineated. They do not, however, suggest that the proximal and distal ends of humeri from 6902 represent the same species, or even genus.

A much more likely agreement with the distal humerus from 6902 is found ^{in prox. frag # 42658 from} at loc. 7136. The mediad position of the head which overhangs a deep ~~bicipital~~ ^{capitae} groove, and the broad pectoral attachment stretching from shaft to head and spanning the external edge of the ~~bicipital~~ ^{capitae} groove closely resemble the condition found in the Fraterculini, and especially in Lunda; ^{that resembles Cerorhinca} also the apex of the shaft anconally is mediad of the pectoral attachment as in Lunda. ~~intxxx~~ The internal contours are incomplete, but the pneumatic fossa seems to be more reduced than in Lunda and the median crest appears to terminate closer to the border of the bicipital crest; palmad the distal edge of the bicipital crest is slightly inset from the internal edge of the shaft as in Lunda, but the line delimiting the crest from the shaft ^{medially} is more marked

Humerus 18283 T coracoid 18282 from Loc 1945
are assigned to also T are said to be smaller
than A. torda. Hence not the same as the specimens here discussed
But check prox ulna 18272 T 2 small frag: 18273, 18281 from 1945

check
ulna at similar
18272
from 18283
Loc 1945
for Lunda

Alcidae

The auronal surface is deeply excavated below the head

Lunda or Fratercula sp.

The Proximal end of humerus (42458) with head abraded and bicipital crest and int. tuberosity incomplete $\frac{9136}{42458}$

The specimen falls in the group that Storer (1958, fig. 2) designates Fraterculini. The head overhangs a deep, ^{narrow} capitulum groove; the ext. pect. attach. broadens proximally and ~~also along~~ ^{partially shows} this groove proximally-externally. (This condition is most marked in the two genera of puffins, ^{Lunda & Fratercula} but is suggested in Certhia as well.) ^{the median crest} continues almost to the edge of the

to head to distal
42658
a 6.5" fr. h. force
b 4.6 " (Fr. h. sec.)
c 15.9 " dist. head
d 6.45 " dist. head
e 7.3 " dist. head
f 4.4 x 6.3 " shaft
g 26.8 " below deltoideus
h 26.8 " 31-I-B
i 24.9
j 15.5
k 6.95
l 7.4
m 4.8 x 6.3
n 11.5

bicipital crest, in this respect closer to Lunda ^(+ Certhia) than to Fratercula. Auronally, the apex of the shaft is medial of the pectoral attachment as in Lunda, in Fratercula it stops ^{medial edge of the} at the distal tip of the attach. & in Certhia it runs into the distal tip. Though it is impossible to reconstruct the contour of the bicipital crest, at least the palmar surface shows a slight inset of the crest from the shaft edge, a condition most closely paralleled in Lunda.

Rated depth
not cond to dist
dist. end
111.070
113.5 (696)
113.5 (661)
118.0 (538)

Prox be 9.5 from ext. border (below head) on a line to median crest (8.5 in Lunda; 8.4 in Frater.; 7.6 in Certhia)
Least br. sh 4.8; Lunda 4.3; 4.0 Frater.; 3.7 Certhia
Sp. depth sh 6.25; Lunda 5.8; 5.6 Frater.; 5.4 Certhia

A Distal end 6902 also falls in this tribe. The dist end ^{places slightly} ~~is~~ ^{auronally} ~~is~~ ^{in which the distal} ~~is~~ ^{condyles palmar}
3.6 x 6.1 ³⁷⁶³⁸ ~~is~~ ^{in which the distal} ~~is~~ ^{condyles palmar}
shaft 6290 3.9 x 6.3 ⁶⁹⁶ ~~is~~ ^{in which the distal} ~~is~~ ^{condyles palmar}
61.4% 3.8 x 6.2 ⁶⁹⁶ ~~is~~ ^{in which the distal} ~~is~~ ^{condyles palmar}
63.6 3.5 x 5.5 ⁶⁶¹ ~~is~~ ^{in which the distal} ~~is~~ ^{condyles palmar}
61.173.3 x 5.4 ⁵³⁸ ~~is~~ ^{in which the distal} ~~is~~ ^{condyles palmar}
dist to 8.0
8.4 (696)
7.5 (661)
6.8 (538)
Depth into
condyle 8.9
a.2 696
5.5 661
7.8 (538)

Alcedae

Uria?

Incomplete prox. end of ~~humerus~~ ⁶⁹⁰² ₅₂₀₁₈

Designable to the tubercle (Stone 1958) on the base of broad excav. of depth of moderate extent, below head, pear-shaped, int. attach. Occasionally the brief surface is prominent toward the ext. side (int side gone) and separated from adjacent part by marked depression bordering its edge. This is much more pronounced than in #42658 & is somewhat suggestive of Pinguinus but to a more marked degree.

Head with apex well for internal side as in Uria or Pinguinus (#42658 appears more central as in Lunda or Heterura)

12.2 x 8	prox/dist hum.	Lunda	
12.3 x 8	" "	"	fossils from 6902 ^{may} 52018, 37638
12.0	" "	"	fossil " 7136 #42658
6.2	head	6902	
6.0	"	7136	
6.9	"	Lunda	
8.8	depth dist	6902	
9.1	" "	Lunda	
18.6	length dist	7136	
19.6	" "	6902	
6.3	sh depth	Lunda dist	
6.3	" "	" prox	
6.1	" "	6902 dist	
6.8	" "	7136 prox	
7.7	" "	6902 prox	

See also *Latimeria*

Sunda from 7136 + 6902

Prox humerus 42658/7136

Differ from *Uria* ^{+ Alca} & agrees with Sunda in shape of pectoral attachment. In Sunda & the fossil the attachment is broader proximally than distally.

In *Uria* & Alca the attachment is long, & narrow throughout its length

Distinguished from *Sunda cirrhata*

Shaft adjacent to pectoral attachment which forms ext. boundary of depression below head forms a ridge. In ~~this~~ *S. cirrhata* the pectoral attachment itself forms the ext. boundary of this area down to the level of the dist. edge of the median crest

I think the fossil is less excavated & less flared at the lower margin of the pneumatic fossa, but the bone is broken here.

Palmar the upper part of the brachial furrow is broader & the deltoid crest is deeper at this point than in *S. cirrhata* (the palmar border of the crest is shallowly rounded in *cirrhata*, more angular (at least at this spot) in the fossil. This is one place in the fossil that is not broken the dist to this spot the border is incomplete

Dist. humerus 37638/6902 Very similar to *Sunda cirrhata*

① Resembles Sunda rather than *Uria* & Alca in anconal contour not deflected palmar distal to level of ectepicond. process.

② Distal view int. depth much greater than ext. (more nearly square in *Uria* & Alca)

③ Attach. ant. art. lig. ^{flator} convex (well depressed in *U.* & Alca) impression of brachialis cutaneous muscle flat & evenly contoured (more even than in Sunda) *U* & *A* ~~is sharply beveled~~ ^{more bevel} ~~is sharply beveled~~ ^{more bevel} ~~contoured distal margin~~

④ deep cut between ext cond & base of ectepicond. process, & sharply contoured, shallower & more uneven in *S. cirrhata*.

fossil
ext cond.
52 x 3.8
52 x 3.5 mod. Sunda

Lr. 3183 (= Hill B Lesine World 1967)

#?, distal ~~end~~ tibiotarsus ~~Pal~~ Megapalaelodus (psiponus?)

Lunda sp.

loc 1902 dist. humerus
mtd. 8.4 br. condyles
11.4 diag. qd. depth dist
37638 9.0 ant. depth
6.2 x 3.6

Loc 7136 prox humerus
mtd. 14.8 br. prox. hum.
42658 9.5 br. 5. med. 1/2
5.9 x 4.4 depth x br. sh.

646
Lunda carinata Uncia 480
8.3 8.5
11.1 11.5
9.2 9.2
6.2 x 3.7 7.3 x 3.8

Uncia 480
16.1 16.2
6.6 9.3
6.0 x 3.9 9.2 x 4.6

Ulna from UCM Pliocene

85904
Probably Uncia
619 length scapula
5.3 prox br. condyles
5.3 x 3.9 depth x 6 sh. med.
7390

60.7 62.2
7.7 8.1
5.5 x 3.5 5.9 x 3.9 (6.7 7.0)
62.5 90

Australia grandis humerus

Brooks
Boreally, paper 1955

length 66.0 (to pect. attach.)
dist. to 2
prox br. 18.3
dist. br. 8.0-8.5
depth head 6.1-6.3
width sh 5.5-6.6
depth sh 3.3-3.8

Ulna prox br. 8.4
dist. 8.7-9.8
prox depth 10.3 (thru ext. condyle)
coracoid length 44.4 (brachio-rotator 5 sh. med. 1)
head to pectoral 17.0

7136 (= A. hamner 7001)

Loc. 690 z - dist hum. 37638

br dist 7.8

int depth 9.0

ht ectop 9.0

br / depth 9.1 X 6.6

above ectop

ratio 62/20

Lunda

could be *prae-maulala*? No

ectop proc. is separate from ext condyle
at its base. Amount of insertion of tricipitalis

stronger or less than *Maulala*

tricipital crest more rounded than *Maulala*

int " " less distally extended & broader

slightly medial

5400

Is this ~~Pterodroma~~ *Micropodidae*?

not locality?

6906 N

check type of *Actinia* check Brachy. *namptus* also

Unrec 47045 Alcedae? *Cephalus*? n. sp.

Suggests *Cephalus* in more rounded, less keel-like shaft than *Uria* and most other alcedae. ~~*Actinia*, *Brachy.*~~

Distinguished from *Cephalus columba* in more prominent ^① at base, for ant. artic. ligament, ^{which is ②} more deeply undercut by the brachial impression; ③ ¹ glenoid impression wider (extends further anteriorly, ~~and~~ (broken int. totyla possibly accounts for space below (where brach. imp. ends) being broader and more squared off prox'ly ④) in palmar view, a prominent ridge descends on the shaft below the int. troch. for a distance of 3.8 mm & appears to be joined at its dist. point by a faint ridge running diagon. from the lower edge of the ext. trochlea (there is a suggestion of this latter diag. "ridge" in one specimen of *Cephalus columba* # 1173 (perhaps papillae rather than ridge?))

	Unrec 47045	C. col. 1172	1173	1174
mid sh br x depth	3.65 x 5.7390	3.2 x 4.47390	3.45 x 5.4990	3.6 x 5.7202
depth brach imp.	3.25	2.4	2.7	2.6
length same	4.2	3.6	4.0	4.0
prox br.	7.4	7.0	7.3	7.3
br. thru ant artic lig. attach. diag.	8.7	8.25	8.2	8.2

More rounded shaft than Alcedae, *Uria* aelfe or *U. lomvia*, *Synaldisa*, *Trachusa*, *Cerobura*

Webster 1940 Jan. Map. *Micropodidae* *micropodidae* 1943, cat. p. 604 2nd specimen of *micropodidae* length 6.0 mm 5 g. br. sh. mid 4.8 least sh. 3.0, dist. condyle approx 4

Hum. type *M. micropodidae* 1943, cat. p. 604 2nd specimen of *micropodidae* length 6.0 mm 5 g. br. sh. mid 4.8 least sh. 3.0, dist. condyle approx 4

Corymboides minutus

		plan pachius	stellata	31173
humerus by th	62.0	139.2	132.7	
ulna "	50.0	111.7	106.4	81.0
prox br ulna	5.9	11.3	10.0	9.4
ratio length	11.8%	10.1%	9.5%	11.6%
h sh ulna	2.8	5.5	4.4	4.9
ratio length	5.6	4.9	4.1	6.0%

Calymene

<i>Gaviella puidla</i>	5.6	10.7	8.9
depth sh - M1		12.5	10.8
" horn - M1	9.0		

Ratio fossil
to Recent sh.

53%	62.9
72%	83.2

Cope prox
mala
gaviella

Fossil to Recent

31173 telon

length	72.5%	75.9%
prox	83.2%	94.0%
sh	89.1%	111.1%

The ~~distal~~ contour of the bicipital surface is somewhat more like Cerorhinca than Lunda. ^{However,} There are more characters linking the specimen with Lunda than with either Fratercula or Cerorhinca. ^{Furthermore,} its size indicates that it cannot represent the previously described Cerorhinca dubia or C. minor. ~~It is, therefore described as new species of Lunda~~

Hyaterevidina as published Lunda barnesi new species Not in final version
Holotype: Incomplete proximal end of left humerus no. 42658,
collected by Lawrence Barnes, July 15, 1971.

Formation and Age; Monterey Formation, Late Miocene

Locality: 7136, 4 miles south of El Toro, $\frac{1}{2}$ mile east Aliso Creek in road cut on east side of Moulton Parkway about 4 feet above roadbed in NW $\frac{1}{2}$, SE $\frac{1}{4}$, NE $\frac{1}{4}$ Section 16 (Unsurveyed) T 7 S, R 8 W, USGS topographic map, San Juan Capistrano 7.5', 1948.

Diagnosis: Distinguished from Lunda cirrhata by narrower anconal groove beneath the overhanging head, and groove marking medial boundary of bicipital surface forming acute angle with distal tontour of surface.

Measurements: Proximal breadth from external edge to median crest 9.5 mm (*L. cirrhata*, 8.5 mm), least breadth of shaft 4.6 mm (*L. cirrhata* ~~4.3~~ mm), greatest depth of shaft 6.25 mm (*L. cirrhata* 5.8 mm)

Referred Material: Distal end of left humerus no. 37638 from
locality 6902, collected by date.

Description; Similar to the puffins as contrasted to Uria and Alca in the slight anconally flare of the distal end. In Uria and Alca the distal anconal contour beeds palmad. The internal tricipital groove is deep and limited in proximal extent, in this respect closer to Fratercula and Cerorhinca than to Lunda. The external tricipital crest is well developed as in Lunda. The ligamental attachment above the internal condyle is broad, with pointed proximal contour, and the condyle is very little excavated (resembling Lunda). In size the specimen conforms favorably with the type proximal end.

Measurements: Breadth distal end 8.0 mm (L. cirrhata 8.1 mm), depth internal condyle 8.9 mm (L. cirrhata 9.2 mm), shaft dimensions 3.9 x 6.3 mm (L. cirrhata 3.8 x 6.2 mm).

Yellow with ~~purple~~^{out} the ~~the~~
actinia & uria

Resembles humerus
in width, great to feet, near
and its associated
longer part of head
in bicipital crest
most from
palmar

The distal specimen flares slightly anconally as in the puffs
as contrasted to the condition in Uria and Alca in which the distal
anconal contour bends palmar. The internal tricipital groove is

Resembles type humerus of Cerulinea minor. LADM 15405
from 65153 - led to Id. in narrower of excav. below head
T its delimitation internally by a definite ridge, ~~difficult to see~~
noted from Cerulinea, also similar to C. minor in length of
median crest (extending to base of bicipital crest)
Remains from head line delimiting bicipital surface is long 14.9
B. across bicip. surf. + ext. margin 14.45' (C. minor 15.5 + 15.7 further med.
but bicip. crest is lower, the length of the surf. is more like Leucorhina
Size = Leucorhina surface larger than the sp. rep. by the Uria from 1945

Busa C. minor 7.9	prox. h. + med. crest	for <u>Uria</u> 6.5 prox. dist. to condyle 7.25' length last and 14.0	ratio of prox. to dist. 86.5%
Alca C. minor 6.0		length bicip. surf. 9.5 ratio to <u>Uria</u> 83%	
1945 C. sp.		for <u>Uria</u> 6.2 (two layers to ref. C. minor)	
6973 C. n. sp. 9.3		two small to ref. new specimen 6.9 7136	
696 <u>Leuca</u> 9.3		7.9 to dist. condyle # 32438	
		length bicip. surf. 15.2 ratio to prox. bicip. surf. 60.7	
		14.7	

42658 differs from type of C. minor in longer bicip. surface
shallower excav. below head

MUSEUM OF COMPARATIVE ZOOLOGY

The Agassiz Museum



HARVARD UNIVERSITY . CAMBRIDGE, MASSACHUSETTS 02138 . TEL. 617 495-2466

13 September 1976

Dr. Hildegarde Howard
Dept. of Vertebrate Paleontology
Natural History Museum of Los Angeles County
900 Exposition Blvd.
Los Angeles, CA 90007

Dear Dr. Howard:

I am sending on loan the specimen of Diomedea anglica (MCZ 2328) which you requested in your letter to Farish Jenkins on 2 September 1976. All avian bones are curated in the Bird Department.

Upon receipt of the specimen, please sign the blue invoice and return it to me.

Very truly yours

A handwritten signature in dark ink, appearing to read "R. A. Paynter Jr.", written over the typed name.

Raymond A. Paynter, Jr.

RAP:ap

Enc.

Loc
6904

Loc Miocene (Montana Fm?)
6902

Loc
3185

Loc
7136

Gavia 31173
Puffins
O. clausen?

ulna 42653

tarsus 42659

wing phal Puffins
no. II

dist. ulna
52748
Puffins

Diomedea tibia, radius
37629 (31172)
frag. tib 37674(?) (dist. h. 10.1)
scapula 1113

Oskodent

frag. mand 22444
carpomet. 53906

frag. mand
42656

Morus 32428
32431
2 tarsus, 37628, mand.
37614
31171

ulna 37636
carpo. femur
37634 37633

tarsus
42657

Morus carpo, hum(?)
large 37632 32430

solid st. jaw frag
dist. tibia 52590
57834

coracoid, 37637
radius 53907

carpomet. 52214

Piaumavella Shineri, ulna
42653, 32432, 32427,

frag hum 52018

Alcid sp. ~~frag hum 37634~~
~~ulna 42654~~

Point hum 37634

R. hum. humerus
42658

Birds?

Unident femur head 37630
cervical 37633
~~phal. 52747~~
sh. carpo. 37631

cervical 37639
phal. 37676, 52592
scapula 42655, 52591
carpal ph 37635
tib. frag. 53908

~~ulna 52748~~
rad. phal. 52747
shapts 52745-46

Goose 76?
carpo, 32332

Case VIII " = 6902 + 6904 - 7136
3185?

Loc 3172
Large dist. ulna of solid [preservation dark smooth as in some 1945 skulls]
but smaller than #37636
in 6902 assigned to Longirostris,
check radius from La 1945
+ compare also with the dactylotus
(then from 1945 are smaller than
dactylotus + are assigned to
Miosula?)

own Orange Co. Calif.,
were first recorded

M. ~~Since the discovery~~ of Miocene avian fossils ⁱⁿ Lawrence

Wald, Laguna Hills (Howard 1966(?)), ~~another Orange County~~
~~area~~ Since then excavations ~~at~~ in Laguna Niguel, southwest
of Laguna Hills have yielded further material, ^{the Niguel deposit is much} of similar, or
possibly slightly later age, ^{but still within the Miocene epoch} though still within the Miocene epoch.

~~Lawrence Barnes (with)~~
~~Mammalian paleontologists report about marine mammals from~~
~~Laguna Niguel related to those through similar to those at Laguna~~
~~Hills, also possible~~
~~Lawrence Barnes (in lit.) has been studying the marine~~
~~mammals, believes the two areas ^{both} to be included in.~~

~~Both are mapped within~~

Four Nat Hist Mus of LACO (LACM) localities are
included in the bird bearing beds: LACM 6906 which
was worked in 196-19- during excavation for the
North American Rockwell building (North Gen. Service Aid.
of USA) and is now completely covered by the building.
LACM 6902 is just a few yards NW of 6906 in ^{on the Mountain Ridge} a
bank at the dead end of El Lago street; LACM 3185 ^T
LACM 7136 ^{on Mountain Ridge} are farther north ^{in an} easterly direction.
At each site the bone bearing bed is in ^{in brown sands} ~~in brown sands~~
between typical Monterey formation shales.
The birds are as follows:

Locality Data -- Laguna Niguel sites

All Monterey formation, Clarendonian, Late Miocene

Loc. 3185 -- Aliso Creek

Lat. $33^{\circ}34'08''$ N Longit $117^{\circ}43'32''$ WTownship/Range NE $\frac{1}{4}$, NW $\frac{1}{4}$, NW $\frac{1}{4}$ unsurveyed Sec 16T, 7S R, 8W

Elevation 390 feet

San Juan Capistrano USGS 1948 1:24,000

Larry Barnes field no. 708 (Mike Bell no. V652)

Approximately 3200 feet West Aliso Creek in 3rd major tributary gully on north side of an intermittent stream that flows east to Aliso Creek, several yards up the gully on east bank in COARSE, YELLOW SAND about 0.1 mi. west 1101

Loc. 7136 -- Moulton Parkway,

Lat. Longit.

Map, San Juan Capistrano 7.5', USGS topographic 1948

Locality about 4 miles south of El Toro, $\frac{1}{4}$ mile east of AlisoCreek, from road cut on east side of Moulton Parkway about 4 feet above roadbed in NW $\frac{1}{2}$, SE $\frac{1}{2}$, NE $\frac{1}{2}$ Section 16 (unsurveyed) T 7 S, R 8 W

Loc. 6901 -- Laguna Niguel Autonetics # 1

Autonetics site on west side of El Lazo Road

360' north of point opposite SE corner with Avila Road

(120' north of pole 1842252E) (1725'NW N510, 424.0/E1, 555, 197.0)

San Juan Capistrano Quadrangle USGS 7.5/1948

Orange County Calif. Zone B

Includes all material from lower laminated gray to white siltstone in cuts around El Lazo Road North of Avila Road

Loc. 6902 -- Laguna Niguel/Autonetics #2

Autonetics plant on west side of El Lazo Road

530' north of point opposite SE corner with Avila Road

(50' north of pole # 1842251E) (1850'NW N510, 424.0/E1, 555, 197.0)

San Juan Capistrano Quadrangle USGS 7.5/1948 Orange Co. Calif. Zone A

Includes all material from hard coarse yellow sands overlying laminated siltstone described in 6901, all around El Lazo

Road north of Avila Road

Loc. 6906 Laguna Niguel Autonetics # 6

General locality for collections by construction personnel and from dump.

6906-G under NW $\frac{1}{2}$ Autonetics building. Pocket of bones screened by Marion J. Bohrer 1969

6906-N (collected by ~~Earl~~ W. Earl Calhoun? 1969-1970)?

Site of excavation for No. Amer. Petroleum Bldg. (now US Gen. Serv. administration Bldg.) on El Lazo Road, Laguna Niguel, Orange County; 3000 feet north of junction of Aliso Creek & Sulphur Creek in yellow sands & laminated gray shale.

Lat. $33^{\circ}33'43''$ North, Longitude $117^{\circ}42'44''$ West.Within NE $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ of unsurveyed Sec 16,

T 7 S, R 8 W, San Juan Capistrano Quadrangle

USGS 1948 1:24,000.

copied from
P. metzner
paper
tributary
gully west of
Aliso Creek
in coarse
yellow sand

sand or
siltstone?

copied from
P. metzner
NW end of El Lazo
Rd, 1200 feet
NW of 6904
800 ft east of
Aliso Creek in
basal 2-4 ft
coarse yellow sand
overlying laminated gray
shale

details?

copied from
P. metzner
paper

Barnes July 15/97

3001?

check this
to catalog

116/900
90/110
over

94/112
240
150
390

TYPE LOCALITIES and other data for specimens to be described NEW

Gavia brodkorbi-- Ulna 31173 (left)

From Locality 6906-G collected by Marion J. Bohrer, 1969

Puffinus niguelensis -- Ulna 52748 (left)

From Locality 7136 collected by Michael K. Hammer, 1970

Morus giganteus -- carpometacarpus 37632 (left)

From locality 6906 collected by Marion J. Bohrer, 1969

Doubtfully new:

Diomedea distal end of tibiotarsus 37629 (left) larger than *D. californica*?

From locality 6906 collected by Marion J. Bohrer, 1969

Diomedea? fragment of distal tibiotarsus (left) smaller than above

no. 37674 collected by W. Earl Calhoun, 1969 or 1970

Locality 6906 in white SS, Southwest part of building, 2nd level

Morus giganteus -- rostrum (probably to be referred to this n.sp)

no. from loc. 6902 collected by Jennifer Whistler,

May (June?) 1975)

Diomedea sp? humerus prox. no. 58544 -- locality 6902

Niguel localities Miocene

Possible Monus longicaudus from Niguel;

10 ~~1~~ Tarsometatarsus (prox.) #32428¹ loc. 6906

10 ~~1~~ Tarsometatarsus (prox.) #42457 loc. 7136

10 ~~1~~ Tibiotarsus (dist.) #52217 loc. 3185

~~1~~ Tibiotarsus (dist.) #53908 shaft below unmarked loc. 6902 (1.3 less than barman)

~~1~~ Tibiotarsus (dist.) #57834 loc. 37633

~~1~~ Femur (dist.) #37634 loc. 6902

~~1~~ Carpometacarpus m. comp. #77697 loc. 6901

~~1~~ Carpometacarpus m. " #37634 loc. 6902 (5.1 mm longer than barman)

~~1~~ Carpometacarpus m. " #37635 loc. 6902

~~1~~ Radius (prox.) #55551 loc. 6902 size = barman

~~1~~ Ulna (dist.) #37634 loc. 6902 (equals barman's)

~~1~~ Ulna (dist.) #37614 loc. 6906

~~1~~ Prostrum

? Microsula media?

Tarsometatarsus (dist. 3/4) #32431 loc. 6906 (see also 17580 for loc. 3172 barman's)

Very large Monus - n. sp.

Carpometacarpus (m. comp.) 37632 loc. 6906

Humerus (dist.) 32430 loc. 6906

shaft of femur (n. dist. end) 37635 loc. 6902

Prostrum 77696 loc. 6902

~~Salidae Prostrum Salidae sp. or Phalacrocoracidae 73565~~

~~Salidae (or Phalacrocoracidae) Prostrum~~

Gavia n. sp. very small

Complete ulna #31173 loc. 6906

Puffinus sp (new?)

Humerus #42452 loc. 6906

ulna #42454 loc. 6906

ulna (dist.) #52448 loc. 7136

DZ P.h. 1 wing unmarked loc. 3185

Osteodontornis

frag jaw, tooth #42456 loc. 7136

frag jaw several teeth #32444 loc. 6902

Carpometacarpus (shaft) 53906 loc. 6902

Parmancella wetmorei

- Humerus m. comp. TYPE # 42453 loc. 6906
- Ulna (prox $\frac{3}{4}$) PARATYPE # 32427 loc 6906
- Humerus (prox) # 32432 loc 6906
- Coracoid (afferens) # 37437 loc. 6902
- Radius (complete) # 53907 loc. 6902
- Carpoacetacarpus (prox $\frac{3}{4}$) # 52214 loc 3185

Alcidae
H

- lidae*
 ✓ *Humerus* (prox) *lidae*? 42458 *lez* 7136 ✓ R. Reynolds 18 Jan 70
Humerus (dist.) *lidae*? 37438 *lez* 6902 Bohrer } Dec 72 - Feb 73
Humerus (prox) sp? *lidae*? 52018 *lez* 6902 Bohrer Jan Feb 1974
 ✓ *Humerus* (prox) sp? *lidae*? 37686 *lez* 6906 Wm + Mrs Bohrer 1970
 X *Humerus* dist *lidae*? 47045 } *lez* 6906
 X *Humerus* *lidae*? 47045 } *lez* 6906
 X *Humerus* *lidae*? 47045 } *lez* 6906

~~Phalangeroides~~ ^{Phalanger} ~~oides~~ ^{oides} ~~Sulda~~ ^{Sulda}? ⁷³⁵⁶ ^{not yet} ^{Nov 4} see one
Robinson 6402
Maurin J. Bohrer Feb 14, 1976

① *Ocaudromes*

- anadroma*
~~Humus (3/4) II 37686~~ ~~loc 6906 (or acid?)~~ ~~acid~~ ~~2~~ ~~1~~
Tarsonotatus II 42659 ~~loc 6902~~
~~II 42654~~ ~~loc 6906 (or acid?)~~ ~~affinis gr.~~
ultra

3 *Diomedea californica* (?)

- Medea californica* loc. 6906 x 4
T. pictarius (dist.) 37629
Radius (dist.) 31172 loc. 6906 x
~~*Fibidarius* (foss) 37679 loc. 6901 (ident?) smaller~~
Humerus $\frac{3}{4}$ 58544 loc. 6902 1

omit sp? smaller
very fragmentary

15-12 Scaphis unidentified

- | 15 Sept 2 | | Scaphis unidentifed | | loc. 7136 omit | |
|-----------|-------------------|-----------------------------|--------------------|----------------|--------|
| 31171 | ped. phal. 6904 | \$2745 | 52746 | wh. tel. ment | " |
| 37630 | head spur " | 52747 | pedal phal. aux | ok | " 6902 |
| 37631 | sh. carpa " | 37635 | frag. center mous? | | " 6902 |
| 37673 | vent " | 52590 | " jaw solid | | " 6902 |
| 37674 | tibia. alba. 6904 | 37639 | vent O | | " |
| 52592 | 37674 | pedal phal. O O | | | " |
| 42655 | | basal frag O | | | " |
| 51591 | | synsacrum O | | | " |
| 53908 | | shaft tibia (longer w/ 5334 | | | " |
| | | | | | over |

21

another
specimen (small)
should have the
same info

*

Osteodontornis jaw #22444

"Loc. 692 / Laguna Niguel
(M.K.H.V. - 6901 Zone "A")"

coll. Mike Hammer 3.1.69

Data slip with this same
692 is 50ft north of "II"
on Calhoun's map. In
stratum above sea lion
(which was in "II")

this has
been
written over
is it 901
or?

Maucalla humerus = Praemaucalla websteri type
42653

"Loc. 6906 - (I) Laguna Niguel

No. Amer. Auto,

coll. Calhoun - March 1970

Osteodontornis "tooth" #42656 Loc. 7136

M.K.H.V. 7001

coll. by MK Hammer 1.18.70

Puffinus sp. humerus

6906-I Laguna Niguel Automobiles

White Sands east side of building

"IX" on map contributed by Calhoun July 1969

Ulna - sp

"Loc 6906-b - Laguna Niguel No Amer. Auto

coll. Keith Carson March 1970

* According to locality book, 692 is associated with
LACM Loc 6906

6902 0901

6906

7134

3185

3185 - Aliso Creek, Orange Co., Monterey fm. ^{late} Mio

Lat. $33^{\circ} 34' 08''$ N Longt. $117^{\circ} 43' 32''$ W

Township / Range NE $\frac{1}{4}$, NW $\frac{1}{4}$, NW $\frac{1}{4}$ ^{unsurveyed}
Sec 14 T7S
R8W

Elev. 390 ft

San Juan Capistrano USGS 1948 1:24,000

Banner photo # 408 (MABEL # V652)

Approx 320 ft W. Aliso Creek in 3rd
major tributary gully on no. side of an
intermittent stream that flows east to Aliso Creek
several yds up the gully on east bank in
coarse, yellow sand about 0.1 mi west 1101

7136 Moulton Parkway, Orange Co., Monterey fm
Clarendonian late Mio.

Lat.

Long.

Map, San Juan Capistrano 7.5', USGS ~~Topo-~~
ographic 1948

Loc. about 4 mi so. of El Toro, $\frac{1}{4}$ mi east of
Aliso Creek, from road cut on east side of
Moulton Parkway about 4 ft above roadbed
in NW $\frac{1}{2}$, SE $\frac{1}{4}$, NE $\frac{1}{4}$ Section 16 (unsurveyed)

T7S, R8W

Banner July 15, 1971

6901 Monterey - Clamundin

Laguna Niguel - Autonetis #1

Autonetis site on west side of El Lago Rd.

360' no. of point opposite SE corner w/

Avila Road (120' no. of Pole 1842252E)

(1725' NW N 510, 424.0 / E 1, 555, 197.0)

San Juan Capistrano Quad USGS 7.5/1948

Orange Co. Calif. Zone B.

Includes all material from lower laminated gray
& white siltstone in cuts around El Lago
Rd, N. of Avila Rd

6902 Laguna Niguel / Autonetis #2.

Monterey Clamundin

Autonetis plant on west side of El Lago Rd.

530' north of pt. opposite SE corner w/

Avila Road. (50' no. of pole #1842251E)

(1850' NW ~~1850~~ N 510, 424.0 / E 1, 555, 197.0)

San Juan Capistrano Quad.

USGS 7.5 / 1948 Orange Co. Calif. Zone A

Includes all material from hard coarse
yellow sands overlying laminated siltstone
described in 6901, all around El Lago Rd. N. of
Avila Rd.

6906 - Laguna Miguel automatic # 6
General locality for collection by
construction personnel + from dump.

Q = under NW $\frac{1}{4}$ automatic Bldg.
bag of bones screened by Bohren

See book for details on bones
within 6906

Orange Co. Mammal Notes
in pocket

✓ Loc 6902 - *Clarendonian*
Morus Sp.

distal ulna 10.5 br trochlea (10.4 in M. Bassanus)
37636 (10.2 x 8.5 max x min. br. shaft fossil)
(9.3 x 8.2 " " M. Bassanus sh)

assigned to
M. longimanus
1976

Resembles Morus in ~~size~~ great excavation (pneumatic?) of
palmar face of distal process also size of morus
Sula has less pronounced process with no excav.

✓ Loc 7136 *Clarendonian*

Morus? sp small tarsus (prox) narrower in shaft
42657 12.2 prox br (14.6 in M. Bassanus)

assigned to
M. longimanus
1976

but all Sula even broader

[check all morus in 1945 and M. vagabundus
from Shasthooth Hill]

Loc 65121 Pliocene Hemphillian

dist. tibia 11.9 x 10.3 br x depth dist end 86.5% br/depth
31631 (13.0 x 10.4 same near M. Bassanus) 80.2%

(13.8 x 9.8 S. dactyletra 70.3

(11.3 x 8.0 S. sula 70.7

11.2 x 8.6 Sula neborxi 78.2

lig. budg more horizontal than Sula
closer to Morus

✓ Loc 6902

Salida

Carphometacarp 37634

94.8 length to ext. trich. crest

89.7 " " " " " in M. Bassanus

10.4 br trochlea (fossil) 10.9 20% length

9.9 " " " (M. Bassanus) 11.0 20% length

assigned to
M. longimanus
1976

Not so much dif bet Sula & Morus in this element

Loc 6902 - femur (dist. 37633)

Closest to Salida. Flatter above condyles (patellar)

than in Dioneida - Br dist end 13.7 mm

Great variation within Salidae even 4 ms sp of Sula slight

diff. in condyle contour but all feet above condyle

assigned to
M. longimanus
1976

$$\begin{array}{r} 1158 \overline{) 10280.0} \end{array}$$

$$\begin{array}{r} 1020 \overline{) 1158.0} \end{array}$$

$$\begin{array}{r} 1020 \\ 1380 \\ \hline 1020 \\ 3600 \\ \hline 3360 \\ 240 \end{array}$$

$$1.132703 \overline{) 783.}$$

$$1.113$$

$$1.113$$

$$\begin{array}{r} 783. \\ 703 \\ \hline 800 \\ 703 \\ \hline 970 \\ 703 \\ \hline 2670 \end{array}$$

Fossils used for comparison with Miguel collection

Gavia conradi - cast of type

" *howardi* - holotype

Diomedea californica - referred humerus

" *anglica* ref. *filistana* (Metzner reference)
on loan

" *mulleri* holotype - ulna, referred tarsometatarsus.

Puffinus tedfordi - holotype tarsus

" *canadi* - cast " humerus

" *mittelli* - " " "

" *prussicus* - " " " + referred humerus from
LACM coll.

" *felthami* holotype "

" *kauahoei* "

Osteodontornis ori - casts of holotype

Myiis lompecanus - cast holotype + 2 original referred

Myiisula media - " " + original holotype

Paleosula stertoni - cast of type

Unio antiqua - cast of type humerus

Myiocephalus macleani - referred ulna + humerus
loan from Lee Cuckel (Stans)

Actitis rosemberi - referred distal humerus

Certhia minor - holotype humerus

" *dubia* - cast of type

Primaucella lagumensis - type + referred material

Sula velluto - cast of type

Pleistocene

late - Rancholabrean

all asphalt depts. of Calif.

probably Manix deposits

Santa Rosa Id. mammals

Anacapa Id. Chendytes lawi

Early - Tertiary

Quartz Borrego valley ^{arch} fauna

San Nicolas Id. Chendytes melleri?

Pliocene - Pleistocene - Blancan

late Blancan - earliest Pleistocene?

Quartz Borrego late creek fauna

Early Blancan - Pliocene (late)

Cozo Mts fauna

San Timoteo fauna

Pliocene -

Hemphillian - mid Pliocene

~~mt. Chen fauna~~ - later Hemphillian

Clarendonian

Pico de fauna

Arroyo fauna, Death Valley

~~Tejon Hills fauna~~ (one of 2 = Pico de map?)

Mt. Canyon faunas (mid-up mid @ corey p 83 Bull no)

Miocene -

(Modelo corey sub Moccasin @ corey)

malaga upper
valencia
upper mid (corey)

Baistonian - late Miocene

Baistonian fauna

citania mid @ corey

Dennigfordian - mid Miocene

Teulobor
mid to low mid @ corey

Rich Canyon fauna? (maybe Antaresian)

Antaresian - Early Miocene

Rich Canyon fm - Vasquez Canyon miobasalt

Teulobor fauna

So. Mt. Sespe beds

Vaquero, Vedder, Sisseton & Freeman - low mid @ corey

Oligocene

Whitneyan - late Oligocene

Sespe fm. - Kari Quarry fauna

Orellan - middle Oligocene

Great Plains - none in Calif.?

Chadronian - early Oligocene

Titus Canyon fm

Sespe fm
Orban to
Antaresian

Eocene

Duchesmanian - late Eocene

Sespe fm - Pearson Ranch fauna C/T 150

Vintana - mid Eocene

Pomay fauna - Rose Canyon shale & Pomay conglomerate

Earliest Eocene

Martinez fm Riverside Co. (Paleocene @ corey)

Qalen fm Kern Co.

55 bones recovered

5 bones Logman Miguelles 38 bones, 13 sps ident.
129 spec. assigned?

Gaviiformes
Gavia new sp. 1

Parasit. Bubo Procellariiformes
none D. calif. 3 Diomedidae
D. medell. Diomedea californica? 3
P. dict. P. pinn. 4 Procellariidae. *harrisi*?
P. mitch. Puffinus niguelensis n.sp. 3
P. mitch. ~~Puffinus sp. + only pharynx~~
none none 1 Hydrobatidae
Oceanodroma sp. 1

Osteodont. Pelecaniformes
3 Pseudodontornithidae
Osteodontornis orri 3

Sulidae
Morus lompopanus 7
Miosula medea? 1
Morus magnus n. sp. 4
Sulidae sps. 3

Anseriformes
none

Pandion
homalopteron

Charadriiformes

Alcidae
5 Alcinae
Lunda? sp. 2
Aethia? sp. 1
Cepphus? sp. 1
Uria? sp. 1
6 Mancallinae
Praemancalla ~~lagunensis~~ n.sp. 6

D. limosa
fisher
Cecropia
dubia

200 bones recovered

Loc. 1945 - 120 bones, 19 sps. ident.
9 spec. assigned

Gaviiformes
none

62 Procellariiformes ★
Diomedidae
1 Diomedea sp. small
1 Diomedea sp. large (Calif.?)
Procclariidae
Puffinus calhouni n.sp. 6
Puffinus prizucs? 1 or 2
Puffinus sp. 1 (+43 to gowith thaborn?)
Fulmarus hammeri n.sp. 2
Hydrobatidae
none

Pelecaniformes
1 Pseudodontornithidae
Osteodontornis orri? 1

Sulidae
Morus lompopanus? 3
Miosula? sp. 9
Microsula sp. 3
Sulidae sp. 7

Anseriformes

4 Anatidae
Presbychen abavus 3
Anser sp. 1 (small)

Charadriiformes

27 Alcidae
17 Alcinae
Alca sp. 2
Cerorhinca sp. 2
Aethia rossmoori n. sp. 8?
Alcidae sp. 5
10 Mancallinae
PRAEMANCALLA watsoni n.sp. 6
Alcedo ulmulus - 4

June 30, 1974

Photos needed 18+ [make it 20]

- 1 ② 2 Tyke 9 Gavia bodharbi ulna internal
- 1 4 Tyke 9 Puffinus niguelensis humerus anterior, internal, posterior
- 1 ② 2 Osteodontornis carphota - int.
- 2073 4 Tyke 9 Morus magnus carphota carphota int. + ext
- 7 3 M. lompopanus carphota carphota int. + ext
- 1 2 Rastum # 73765 Miosula? ventral + dorsal
- 2 4 Diomedea humerus + tibia

10 bones 20 views

THE PILGRIMS' PLYMOUTH

By Edith M. Sanders

The breaking waves dashed high
On a stern and rock-bound coast,
And the woods, against the stormy sky,
Their giant branches tossed. -- Hemans.

When Americans think of Plymouth, Massachusetts, these lines
of an early poet come to mind. But today one finds no

Compared to the avifauna from the Late Miocene deposits at LACM locality 1945, about 5 km to the north of the present localities, the species now encountered suggest similar ecological conditions. With the exception of the Loons ^{and} in the present collection, and the Anseriformes, at 1945,

~~With the except~~

~~The families~~

Albatross, shearwater, sulids, Osteodontornis, alcine and mancilline alcids are represented from both areas. Only two ^{or three} species seem to be represented at both localities, ^{but these are tentative assignments at one or both} and one of these (Morus lompopcanus) ^{is} is only tentively reported from LACM 1945. The new species Puffinus calhouni and Praemancalla lagunensis from LACM 1945 are replaced in locality 6906 by Puffinus niguelensis and Praemancalla wetmorei.

Loons 1 Does this indicate both 1st arrival of loons? ^{& / this area?} None

Albatross tentatively D. californica

Two species neither assigned

Shearwater, new species

Shearwaters P. calhouni, ^{sp}

P. priscus?

None

Fulmar

Petrel

None

Osteodontornis orri

. orri ?

Morus lompopcanus

M. lompopcanus?

USE THIS but revise

When Miller (1925) described Puffinus diatomicus and three species of sulids from the Lompoc diatomite of California, only one other species of fossil shearwater and one other species of fossil sulid were known from North America. Today, fifty-one years later, there are 10 shearwaters and fifteen sulids listed for the North American Tertiary (Brodkorb, 1963). As additional fossils of these groups continue to appear, the task of correctly assessing their relationships becomes increasingly difficult. Preservation varies and skeletal elements preserved may not be the same as those previously described. Indeed both groups should be completely reviewed using large series of modern species as a check for degree of valid variability. This is a task that some energetic young paleontologist anxious to establish a reputation and show up the errors of his elders may profitably undertake.

In the meantime the continuing flow of specimens must be recorded -- assigned to previously named species wherever logical, or where distinctions seemingly outweigh similarities, described as new. ~~on~~ ^{in the} ~~this basis~~, I have assigned several of the sulid bones to the previously known Morus lompcanus. This assignment is well within the probability of occurrence both chronologically and geographically. A second species of sulid and one shearwater do not conform to previously described forms and are described as new.

Additionally, a new sp. of loon is named - the first Miocene species of the genus Gavia to be described. Thirteen albirds have been previously described from the North American Tertiary, eight albirds from the Miocene. ~~of the Miocene~~ ^{of the Miocene} ~~have been~~ ^{have been} ~~discussed~~ ^{discussed} ~~in recent work~~ ^{in recent work} that of the Miocene have been discussed appear to rep. similar ecologic conditions. The differences noted in species rapid ~~and~~ ^{Therefore}, probably indicate slightly different age.

When Miller (1925) studied the ^{amphimorph from the} Late Miocene diatomite at Lompoc, Calif., he described one species of shearwater, 3 sulids, an albird and a shorebird. At that time only one other sp. of fossil shearwater and other fossil sulid were known from N. Am.

add
Gavia
Oceanodroma
albirds

Historical Background

The first documentation of Miocene marine bird life on the west coast was Miller's (1925) report on the Longfor Diatomaceous deposits in Sta Barbara Co. Calif. He recorded 12 partial skeletons (11 of which were well preserved) which he assigned to six species: *Puffinus diatomicus*, *Sula willetti*, *Sula* [monos] *longforensis*, *Mosula media*, *Limosa vaucrosensis*, & *Evolutica dubia*. At this time ^{Miocene marine records} ~~there was only one other~~ ^{the east coast included} ~~one alcid~~ ^{one alcid} ~~from all of North America~~. A single bone of an Early-Middle Pliocene flightless Auk, *Mancalla californensis* Lucas (1901) was the only previous Calif. west coast record. ~~The last 50 years have added~~

of the groups represented in the present collection, the last 50 years have added 38 Miocene-Pliocene species 28 of which are from the west coast. The problem of identification As new sites are discovered and additional specimens found, the task of ~~determining relationships with previously named species~~ ^{determining relationships with previously named species} ~~has become increasingly difficult~~ ^{has become increasingly difficult}. Rarely is it possible to compare similar portions of the same element. ~~from different~~ The problem is particularly acute in the case of the shearwaters & the *Sulids*. There are now 7 Mio - three Plio shearwaters recorded from N. Am. & 5 Plio *Sulids*. Both groups should be completely revised. ^{Recent specimens}

<i>Sula underhilli</i> Mio Fla	<i>Puffinus micraulax</i> E Mio Fla	<i>Micropodiceps</i> Mio
" <i>gabli</i> L Mio Calif. ✓	" <i>comadi</i> M Mio Md old	" <i>mmp</i> Md
OLD " <i>willetti</i> " " old	" <i>riceptu</i> M Mio Calif ✓	" <i>C. dubia</i> LM Calif ✓
" <i>guano</i> E Plio Fla	" <i>calhouni</i> L Mio Calif ✓	" <i>C. minor</i> M Plio Mex ✓
" <i>phosphata</i> " " Fla	" <i>pussey</i> M Mio Calif ✓	old <i>U. antiqua</i> M Mio N. Cal.
" <i>humilis</i> L " Calif ✓	" <i>mittchelli</i> M Mio Calif ✓	<i>Australogravis</i> E Plio Fla
<i>Mosula arcta</i> M. Mio Md.	" <i>diatomus</i> L Mio Calif old	<i>Bradyptilopterus</i> L Plio Calif
OLD <i>Mimus locustylus</i> M " " N. Cal.	" <i>felthami</i> M Plio Calif ✓	<i>Phrynosphytes</i> 2 Plio Calif
" <i>vagabundus</i> M " Calif ✓	" <i>hansfordi</i> L Plio Calif ✓	<i>Aethya americana</i> L Mio Calif
OLD " <i>longforensis</i> L " Calif old	" <i>sedfordi</i> M Plio Mex ✓	<i>Alcedo subulax</i> L Mio Calif ✓
" <i>pennsylvanica</i> E Plio Fla		<i>Pharmacoctenax</i> L Mio Calif
<i>Palaeosula stochtoni</i> L Mio Calif ✓		<i>Pharmacoctenax</i> L Mio Calif
OLD <i>Mosula media</i> L Mio Calif old		<i>M. diegensis</i> L Plio Calif
" <i>renewbii</i> L Plio Calif ✓		<i>M. mulleri</i> L Plio Calif

Diomedea Calif
D. mulleri
D. thuyidata
D. anglica

Pre 1925

- D. anglica* Eng. 1891 Plis
Podiceps fusarius Gmel 1889 Plis
✓ *Puffus arvernensis* France 1871 Mis E
✓ " *aguiptensis* " 1874 Mis M
✓ " *antiquus* " 1874 Mis M
✓ *Angerodytes microrhinus* Argentina 1905 M.D. E (Procellariidae)
✓ *Pterodroma delforai* France 1858 Mis Mis " "
Phalacrocorax micraeus 1867 Mis E France
" *littoralis* 1863 France Mis E
" *intermedius* France 1867 Mis L
" *destefani* Italy 1902 Plis M
✓ *Microsula pygmaea* 1854 France Mis M,
✓ *Pseudodontornis longirostris* ? Mis ?, 1960
✓ *Belagornis micraeus* 1857 France Mis, M
Cyphornis major 1894 Brit. Col. Mis E,
Palaechinus micraeus 1914 So. Calif. Mis E
Pelecanus gracilis 1863 France Mis E
" *intermed.* 1820 Germany Mis L
" *fraasi* 1891 Bavaria Mis L
" *rivaleus* 1880 - India Plis E
" *odessanus* 1884 Ukraine Plis E
Pelecanus *Liptornis hesternus* 1895 Argentina Mis M

Puffus conradi Md. Mis 1870

Phalacrocorax marinus 1915 Oregon
Mis E

" *idahoensis* 1870 Idaho Plis M

Morus lyntyla 1870 Md. Mis M

Birds of Wgo. marine?

Historical Background

Misc

1925 - Lomboc. -

- ✓ *P. diatomis*
- ✓ *S. willisti*
- ✓ *M. lombricus*
- ✓ *Miosula media*
- *L. varroensis*
- ✓ *C. dubia*

1930 - Sharktooth Hill

- ✓ *P. inceptor*
- ✓ *P. sp.*
- ✓ *M. vagabundus*
- Presbyther abatus*

1929 - Galapagos

1935 - *Diomedea* sp.

- ✓ *Sula stictotis*
- ✓ *P. diatomis*

John Day Beds Lamm Mt. Or

1915 - *Luticola plumianella* Shufeldt

1930 - *Paraceras perpuscula* Webber

1935 - *Palaeobates sulcatus* Bradburn

Phocine

✓ 1901 *Maula californensis* Lucas

Phocine 1932 - Santa Barbara

1933 - *M. calif.*

✓ 1937 - *Phoca dikei* Miller

✓ 1970 - *Maula media*

1940 - Monterey Co

✓ *Gavia cretacea* Wetmore

1937 - Kern Co.

Colymbus farrus Wetmore (Hyke from Forest Lake)

1955 - *Sinosa ossivalis* - Bone Valley Florida Low. Plis Bird Club 1967 or 1955?

1958 - *Bartramia unatilla* Bradburn Mid Plis - Oregon (not a number)

1954 - *Eucia penepuscula* Bradburn Bone Valley E. Plis Fla.

1963 - *Ereunetes rayi* " Alachua clay E. Plis Fla.

1954 - *Calidris parva* " Bone Valley E. " Fla.

1924 - *Micropalama heermans* Wetmore Beuron Aug. up Plis

1955 - *Palaeobates sulcatus* Bradburn Bone Valley Fla. E Plis

Eocene ~~extinct~~ *Palaeobates granis* 1872 Mal

XX Wgo. *Nautilites* greenlandensis 1926 Alcidae 1931 *Hydrotherionis* orig. Alder

Oligo. Saskatchewan 1963 *Paractitis bairdii* 1963 (related to totanus - numerous)

X 1881 *Charadrius shufeldti* Colo. mid Oligo

✓ 1940 *Micropalama mackayi* Wet, Calif. Md.

X 1880 *Via antipus mackayi* to Carol. (Plis?)

1914 *Actitis americana*
Alcedo alaudina
P. lagopus
1916 - *P. vittatus*

1970 *Actitis*
Antipus
Perdix

25 sps.

12 locs.

- 1 Pyramid Hill - Kern Co. Early mid. 1969 - 1 sp., 1 Bon
Shachbrook Hill Kern Co., Mid, Mid 1930^{met}, 1961 and 1962 Miller, 1966 H
1 bone Granite Creek, 11 mi. no. Bakersfield 1 Compton 1936 (M. vagabunda)
1 ref. Point Fermin 1944^H unidentified Late Mio.
1 Calabasas, P. fernalis 1929 Late Mio. shel
3 Sherman Oaks 1962 Late Mio
1 ref. Studio City 1958 Zula poble H Late Mio shel.
1 ref. San Pedro Breakwater 1935 shel. Late Mio
1 sp. 1 shell Sonoma diatomite 1935 Miller, 1955 H
Sula chrestoni
1 ref. 1 sp. 1 bone Lemoore Wash 1968 Late Mio
1 ref. El Sereno 1958 " "
3 ~~diatomite~~ Tepusquet, 1957, 1958 shells.

5 localities

- 4 locs. Phivene 19 sp. (16 main ^{duds} 1 pin 1925)
del Capitan fm, Orange Co. E. ? Plio Oceanodromakultsi shel. ASI
bone Sweetwater Canyon, Monterey Co. Gavia concinna E. M. & P.
2 sh. 1 ~~bone~~ 1067 - Corona del Mar.
3rd H Tunnel (90) Mancallacaly.
many 12n. sp. San Diego. 1949, 1958, 1970
Baja Calif

Ret'd

Bring home

Coracoid 37637 (Loc 6902)

Coracoid #39560 (loc 3221)

Coracoid Pranaucella (Loc 1945)

+ coracoid of Pinguicula, Lunda etc

At museum check

- ① Carpometacarpus 52216 with A
paratype & referred
P. laguneensis

- ② Humerus 42653 with
type P. laguneensis

check - snake - from
3184 to Pranaucella
Case VIII 10

check again all items
from 6902, 6904, 3185, 3221, 713
1945 Alca coracoid & humeri 1945
18282, 18283

12 Fossil 12

Humerus 42653 Loc. 6906-N

Praemancalla

Ulna (prox.) 32429 " 6906-N

Praemancalla?

Carpometacarpus 52216 Loc. 3185

Praemancalla?

Humerus 2670 San Diego fm

Mancalla

Humerus 2858 " " "

"

Ulna 2323 " " "

"

Ulna 2248 " " " (Loc 1079)

"

Carpometacarpus 2541 " " "

"

Carpometacarpus 2033 Loc 1067

" calif.

Prox humerus 52018 Loc 6902

Alula

Dist " 37638 Loc 6902

"

Prox " 42658 Loc 7136

"

25 Modern

of Cephalus?

Humerus & R + L ulnae - Great auk

Carpometacarpus - " "

Humerus, ulna, carpometacarpus - Moore # 485

" " - Razobill auk # 1849

" " carpometacarpus - Puffin # 661

" " " - Puffin # 696 (Lunda)

" " Synthlibrauplus 693

" " Brachyauptes 1176

" " Eudomychura 1132

Humerus ulna - Cephalus 1113

" Cerorhina 838

" Auklet 296
Ptychocarpus

Ref'd

Fossil bird bones

Coracoids 37637 (Loc 6902)

15289 (" 1945)

39560 (" 3221)

2581 (" 1067)

51925 (" 1729)

2067

2310

2269

2229

} San Diego
formation

Modern coracoids for comparison

Uria 485

Pinguinis

Sunda 696

Tratricula 661

Alca 1189

Red

Borrowed - June 27, 1974

Heldegard Howard

10 Fossil bird bones 10

Redd

July 11, 1974

Tranmanicalla

Humerus 42053 - Loc 6906

Ulna (prox) 32429 - " "

Carpometacarpus 52216 - Loc. 3185

Manicalla aligense

Humeri 2470 and 2858 (San Diego 4m)

Ulnae 2323 and 2248 " " "

Carpometacarpus 2541 " " "

Manicalla californiensis

Carpometacarpus 2033 Loc 1067

Alcedae sp.

3 humeri - 2658 (Loc 7136), 52018 + 57638 (Loc 6902) ^{57th}

24 Modern bird bones - 23

Humerus & ulnae (28) + carpometacarpus - Great Auk

Humerus, ulna carpometacarpus Murre #485

Humerus ulna. — (Alca) Auk #1849

Humerus ulna carpometacarpus Puffin #661

" " " " #696 (Lundy)

Humerus, ulna — Murrelet #693 ^{*Synthlibistergus*}

Humerus, ulna — Murrelet #1176 ^{*Brachyramphus*}

Humerus, ulna — Murrelet #1132 ^{*Quidomychus*}

Humerus — Gullinor #1173 (Cplius)

" — Carolina #838

" — Pterodroma 296

1 *Osteodonta* *carinata* from 6902

Length to break of M2 = ~~11.2~~ 126.4 mm, length proc. M1 62.2 mm
[Total length of type spec. 252 mm]

Breadth trachea 15.5?

Pr. fur and through inter ~~trachea~~ ^{pitiform process} 20.7?

Pr. shaft M2 11.2

Depth shaft M2 + M3 16.4

Pr. M3 4.2

Very deep groove lateral (ext.) just below process M1 + slightly ext. (is this true or due to crushing?)

M3 pressed against M2 + ~~just above level of dist tip of~~
proc. M1. The 2 are fused ~~to~~ ^{prox. metacarpal symphysis}
extends almost to level of dist tip of proc. M1

Trachea appears to be dist. probably

Prominent pitiform process with deep foramen above.

Set exactly with impression of left carpo. on type - large pitiform made deep hole

Seems to conform in size to *O. ori* cast, but long M1

Totally unlike *Sulids* except foramen above pitiform present

Only thing like *Albatros* is straightness of shaft

M1 15.13% of length ^{of carinata} in albatros (exulans)

M1 15.13.2% " " " " *baranus*

M1 15.24.6% " " " " *osteo ori* (if length of type is also length of the specimen at 6902)

Humerus *O. ori* type
dist. br. 5.7% of length of avian portion

Ulna *O. ori* type
dist. br. 2.08% of length of ulna
prox. dist. br. 4.8% of " " "

carinata from 6902
If length = to type of *O. ori* (252 mm)
prox. br. = 6.2% of length
[same % in *M. baranus* 11.0]

long from below M1 ext. & apical
M2 may be even longer

Look up Andrews, C.W.

Proc. Zool. Soc. Lond. 1914 1519-524, figs 1-2

- ① Description of *Gigantornis eaglesoni* - type specimen
Twice the size of the albatross So. Africa Eocene?
Lambrecht (p. 206) says its relationship is between the
"Tubinares + Steganopodes."

- ② *Pulagornis miocenus* Lartet 1857 up Miocene Bordeaux
See fig. in M-E Vol. 1 plate 45, figs 1-7 + description p. 273-274
(Tortor)
Three humeri have been found 1st in marine Malaise of Armagnac
(now in Paris Mus.)
later 2 more in lower Mio. (Burdigale) near Bordeaux now
in Bordeaux Mus. with cast in Brit Mus.
This find was described by M-E
Length 580 mm resembles *Diomedea* @ Lartet + Lubbock
but M-E thought it more like *Sula*. Larger than *Diomedea*

- ③ *Argillornis longipennis* Owen 1878 - Eoc. Clay Shephey
Quart. Jour. Soc. Lond. 30: 708-710, fig. 1
"giganteus"
Cranium, humerus, ulna,
skull 135 mm feat (190 complete?) ^{over say} resembles *Diomedea*
in transition stage between *Proterops* + *Proterops*,
lack of supraorbital groove, Lydekker says like *Sula*
Head "outlets of 4 small vertical pits like orbits of teeth."
Humerus more *Sula* than *Diomedea* like, ulna also.
Ulna frag. 468 mm.
Foot not known

- ④ *Odontopteryx foliacea* Owen 1873 - Low Eoc. London Clay of Shephey.
Skull with teeth.
Prox ulna + tarsus repaired

- ⑤ *Pseudodontornis longirostris* (Spuller) - Brazil? age?
Skull - Gigante 400 mm incomplete

21 Sept. 1976
L. Barnes.

- ① Enlarge abstract to give all pertinent facts.
- ② Give author + date at first appearance (after abstract) of any genus + species in text.
- ③ Suggest putting taxonomic list (p. 3) in summary section for 2 reasons:
 - 1) So as not to duplicate or appear to duplicate the listing of them in abstract, in the Systematics section, and so not to be too close to the list of previously described taxa.
 - 2) So not to create nomina nuda.
- ④ Use the epochs in primary age citation and the land mammal ages in parens, since the latter are the more derived or subjective age calls.
- ⑤ Enlarge Intro. to include a brief review of previous pertinent publications.
 - 1) Miller's on Oceanodroma hubbsi
 - 2) Howard 1966
 - 3) Howard, 1968
 - 4) Howard, 1976
 - 5) Miller, 1976 on avifauna as standard of comparison.
 - 6) Miller, Howard, etc. Sharktooth Hill avifauna " " "
- ⑥ Beef up conclusions. Should flesh out the suggestion of a succession of Late Miocene avifaunas in the Monterey. We can get some geologic evidence into it. ie LACM 1945 is at base of Monterey + LACM 6906, 6901-6902, etc. are at top of Monterey Fm. This gives us a start on some biostratigraphy.
(over)

⑦ Acknowledgments

- 1.) Marion J. Bohreer + family
- 2) North American Rockwell Land Company
- 3) Moulton Ranch people
- #? 4.) NSF grant (DEB 7202014), NSF Care-of-collections grant to Nat Hist Mus. Foundation of La. Co.
- 5.) Janet Price + family
- + 6.) Jennifer Whistler
- 7.) Bob McKenzie, } Mus.

- Larry Barnes, }

- Photographer - Larry Reynolds

Bohreer, ^{employee of} Varland Corp. (No. Amer. Rockwell Land Co.)

was assigned at site during construction & during time of salvaged fossils and has continued to do for last even since, Janet, wife & daughter assisting)

No. Amer. permission to collect & quarry,

Mrs. Louise Hanson gave permission to collect in Moulton Ranch.

Janet Price & ^{by 2 mules} family collected for Mus.

Son Raymond

Rodney

Raschke helped Mus. coll.

PB 16291 m. base skull

OK as of Oct. 6, 1976
Cont subject to revision
1st 10 ffs are Xeroxed

LATE MIOCENE BIRDS FROM ORANGE COUNTY, CALIFORNIA¹

revised
1st 10 ffs
Oct 10 are
included
herein

By Hildegarde Howard²

For: Contributions in Science

Running head: Miocene birds

¹Review Committee for this Contribution

Lawrence A. Barnes

Pierce Brodkorb

Stuart Warter

David Whistler

²Chief Curator Emeritus Natural History Museum of Los Angeles
County.

M E M O R A N D U M

February 25, 1977

To: Ed Ostermeyer

From: Lawrence G. Barnes

Subject: Hildegarde Howard Manuscript

Enclosed please find one copy of a manuscript by Dr. Hildegarde Howard, Chief Curator Emeritus, Earth Sciences, entitled Late Miocene birds from Orange County, California. I have read it and find it suitable for the Contributions in Science series. The scientific work is of good quality. It would be Priority 2. I have made a few comments in pencil in the text, and additionally would suggest that the author include the common names of most of the birds in the introduction, text, or conclusions. I feel then the non-specialist should be able to learn at a glance what birds are included.

I will act as Chairman of the Review Committee at the request of Dave Whistler, and suggest the following reviewers:

Dr. Pierce Brodkorb
Department of Zoology
University of Florida
Gainesville, Florida 32611

Dr. Stuart Warter
Department of Biology
California State University
Long Beach, California 90840

Dr. Storrs Olson *signi-folology*
Department of Vertebrate *Zoology*
~~Palaeontology~~
National Museum of Natural History
Smithsonian Institution
Washington, D. C. 20560

Dr. Kenneth E. Campbell, Jr.
Department of Zoology
University of Florida
Gainesville, Florida 32611

Of these, Olson and Warter will probably be able to review the manuscript most quickly. I sincerely want to have this published on the 1976-77 budget for Earth Sciences

LGB:pz

cc: David P. Whistler

Revisions?

||||| ||||| |||||

p. 3 - Miller 1935

p. 4 - Line 5 "15 years" Since the article
goes to press in 1977 this should read 16 yrs

p. 6 - greatest

Table ① p. 9 - Indicate "Table I here" in margin
adjacent to last ¶ (when Table I
is mentioned)
but p. 9 & 10 or mp. 10
pts 2 & 3

p. 13 : rather than semi colon (about midway of page)

p. 14. Rheinschen bach h (not K)

Bonaparte (B (not D))

p. 15. No ¶

p. 16 cap L ate

p. 16 - we still don't have a UCM P II for
UCLA 2838

p. 12 ^{p. 19} Palaeosula

p. 19 insert (to)

Table ② p. 20 - indicate Table II here (1st ¶)

P20 - 73565

p. 22 Unia ausonia (not S)

p. 23 delete dash between deeply undercut

p. 24 comma after however line (6)

p. 25 lower case t. tibialis

p. 27 described
^

p. 28 delete E in acknowledgments

p. 29 grant 270 2014

p. 32 palmar a r l transposed

Table 1 p. 33 align

p. 34 underline ^{sid} heads?

Fig. 1-2 near p. 8-10

~~Fig~~ 3-4 p. 19-20

VCC 2838 = VCCP 117309
p. 16

Vp. 14 > X

Late 2nd line
Vp. 28 middle Miocene cap.
(resp)

Vp. 36 >

Middle & late?

H. Howard copy
✓ in margin = changes
by LGB 1 Jun 1977

LATE MIOCENE MARINE BIRDS FROM ORANGE COUNTY, CALIFORNIA¹

By Hildegard Howard²

For: Contributions in Science

Running head: Miocene birds

¹Review Committee for this Contribution

Lawrence G. Barnes

Storrs L. Olson

Stuart Warter

²Chief Curator Emeritus Natural History Museum of Los Angeles County

LATE MIOCENE MARINE BIRDS FROM ORANGE COUNTY, CALIFORNIA¹

By Hildegard Howard²

Abstract: Bone fragments from five sites in the Late Miocene Monterey Formation at Laguna Niguel, Orange County, California, represent at least 14 species of marine birds, Gavia brodkorbi n. sp., Diomedea ?californica, Diomedea sp., Puffinus barnesi n. sp., Oceanodroma sp., Osteodontornis orri Howard, Morus lompocanus (Miller), Morus magnus n. sp., ?Miosula media Miller, ?Uria sp., ?Cepphus sp., ?Aethia sp., Fraterculini gen. and sp. indet., and Praemancalla wetmorei Howard. The avifauna suggests a slightly younger phase of the Late Miocene than another avifauna previously reported from the Monterey Formation in Laguna Hills, three miles northward.

INTRODUCTION

In 1969, during the excavation for the North American Rockwell Building (now United States General Services Administration Building) on El Lazo Road in Laguna Niguel, Orange County, California, fossiliferous sands and siltstones of the Late Miocene Monterey Formation (Clarendonian correlative) were exposed. Marine mammals and birds were collected in the actual building excavation and, from 1969 to 1976, in adjacent hillsides within a half-mile radius of the El Lazo site.

The localities, all of which bear Natural History Museum of Los Angeles County (LACM) locality numbers, are listed below (numbers in parentheses indicate the number of avian bones found). Detailed locality descriptions with

¹Review Committee for this Contribution
Lawrence G. Barnes
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Stuart Warter

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reference to the San Juan Capistrano Quadrangle, U.S.G.S. 7.5 minute, 1948 edition, are on file in the Section of Vertebrate Paleontology, LACM.

LACM Loc. 3185 -- Aliso Creek. From coarse yellow sand. (3)

LACM Loc. 6901 -- El Lazo Road. In laminated gray to white siltstone. (1)

LACM Loc. 6902 -- El Lazo Road. From coarse yellow sands overlying siltstones described in LACM 6901. (21)

LACM Loc. 6906 -- Site of excavation for North American Rockwell Building on El Lazo Road. In yellow sands and laminated gray siltstone. (21)

LACM Loc. 7136 -- Moulton Parkway. In phosphatic pebble bed, in a gray siltstone. (5)

MATERIAL

Fifty-one avian bones fragments were recovered from the Laguna Niguel localities. These are in the collections of the Natural History Museum of Los Angeles County (LACM). Thirty-nine are identified and assigned to seven families.

Comparative fossil material used in connection with this study is largely in the LACM collections and includes, in addition to LACM types and referred specimens, casts of types of Gavia concinna Wetmore 1940; Diomedea californica Miller, 1962; Puffinus conradi Marsh, 1870; P. diatomicus Miller, 1925; P. inceptor Wetmore, 1930; P. mitchelli Miller, 1961; P. priscus Miller, 1961; Osteodontornis orri Howard, 1957; Sula willetti Miller, 1925; Morus lompocanus (Miller, 1925); Miosula media Miller, 1925; Palaeosula stocktoni (Miller, 1935); and Uria antiqua (Marsh, 1870).

In addition, the following material was made available on loan: from the Museum of Comparative Zoology, Harvard University (MCZ), referred tibiotarsus (Wetmore, 1943) of Diomedea anglica Lydekker, 1891; from the Museum of Paleontology, University of California, Berkeley (UCMP), type and reverse of type of Miosula media Miller, 1925, and figured specimens of Morus lompocanus (Miller,

1925; pls. 7 and 9); from the United States National Museum of Natural History (USNM), previously unreported referred humerus and ulna of Miocepheus mcclungi Wetmore, 1940, identified by Storrs Olson.

Recent skeletal material used for comparison is largely from the LACM collections, but also includes skeletons of Alcidae obtained on loan from the Museum of Vertebrate Zoology, University of California, Berkeley (MVZ) and California State University, Long Beach (CSLB), and a skull of Morus bassanus lent by Pierce Brodkorb, University of Florida, Gainesville (PB).

HISTORICAL REVIEW

Miller (1925) was the first to document Miocene birds from marine deposits in California, naming three species of sulids, a shearwater, a godwit and an auklet from the Late Miocene diatomaceous shales of the Sisquoc Formation near Lompoc, Santa Barbara County. Within the next ten years three sites in Los Angeles County yielded Late Miocene avian fossils: the Modelo Formation at Calabasas (Miller, 1929), and the Monterey Formation at Lomita and San Pedro (Miller, 1935). Also, in the same decade (1925-1935), the first avian bones from the Middle Miocene ^(Round Mountain Silt) ~~(Temblor Formation)~~ Sharktooth Hill Bonebed were recorded (Wetmore, 1930). By the end of 1935, 11 species had been described.

No further marine birds from the California Miocene were added until the 1950's when a flagstone quarry in the Monterey Formation in Tepusquet Canyon, Santa Barbara County, yielded two avian skeletons. Both were described under extinct families (Howard, 1957a and 1957b). Later excavations in the San Fernando Valley and at El Sereno, Los Angeles County, yielded additional records of some of the previously described species and added a new sulid (Howard, 1958, and Howard and White, 1962). Miller (1951) described a storm petrel during this decade, from the Capistrano Formation near San Juan Capistrano, Orange County. The age of the deposit was given as Middle Miocene, but is now considered to be either Late Miocene or Early Pliocene (Fife, 1974:19).

The 1960's added two Miocene Bird localities in California: the Jewett sand at Pyramid Hill, Kern County (Early Miocene) yielded a single bone described in a new family related to the cormorants (Howard, 1969), and a large collection from the Monterey Formation at Leisure World, Laguna Hills, Orange County added five new species (Howard, 1966a and 1968). Also, within the last 16 years, five additional species have been described from the Sharktooth Hill Bonebed (Miller, 1961 and 1962; Howard, 1966b; Warter, 1976).

In seven of the 11 areas in California from which Miocene marine birds have been previously obtained, the specimens occur as partial skeletons or skeletal impressions on slabs of shale. Such specimens include the types of 12 of the 26 recorded species. While these specimens provide information on the proportions of the birds involved, the finer details of structure are usually not clearly preserved. Consequently it becomes difficult to compare these specimens with the isolated, mineralized bone fragments obtained from localities such as Sharktooth Hill, Pyramid Hill, Laguna Hills Leisure World, or the area discussed herein.

In the following list of species from previously recorded marine Miocene sites in California, those based on partial skeletons in shale slabs are marked with an asterisk.

Procellariiformes

Diomedidae: Diomedea californica Miller, 1962; D. milleri Howard, 1966.

Procellariidae: *Puffinus diatomicus Miller, 1925; P. inceptor Wetmore, 1930; P. mitchelli Miller, 1961; P. priscus Miller, 1961; P. calhouni Howard, 1968; Fulmarus hammeri Howard, 1968.

Hydrobatidae: *Oceanodroma hubbsi Miller, 1951.

Pelecaniformes

Pseudodontornithidae: *Osteodontornis orri Howard, 1957.

Sulidae: *Sula willetti Miller, 1925; *Sula pbhli Howard, 1958; *Morus lompocanus (Miller, 1925); M. vagabundus Wetmore, 1930; *Palaeosula stocktoni (Miller, 1935); *Miosula media Miller, 1925.

Phalacrocoracidae: *Phalacrocorax femoralis Miller, 1929.

Plotopteridae: Plotopterum joaquinensis Howard, 1969.

Anseriformes

Anatidae: Presbychen abavus Wetmore, 1930.

Falconiformes

Pandionidae: Pandion homalopteron Warter, 1976.

Charadriiformes

Scolopacidae: *Limosa vanrossemi Miller, 1925.

Alcidae: Aethia rossmoori Howard, 1968; *Cerorhinca dubia Miller, 1925; Alcodes ulnulus Howard, 1968; Praemancalla lagunensis Howard, 1966.

Passeriformes

Palaeoscinidae: *Palaeoscinis turdirostris Howard, 1957.

The species represented at Laguna Niguel bring the total for the Alcidae to five identified species, and the totals for the Procellariidae and the Sulidae to seven species each. The Order Caviiformes (Gaviidae, 1 species) is added to the California Miocene list.

SYSTEMATICS

Order GAVIIFORMES

Family Gaviidae -- Loons

Genus *Gavia* Forster, 1788*Gavia brodkorbi*, new species

Fig. 1 A, B

Holotype.-- Complete left ulna, LACM 31173, collected by Marion J. Bohrer, 1969, from locality LACM 6906.

Diagnosis.-- ^{Ulna}Relatively short and stout; ^{ec}Proximally, attachment for anterior articular ligament short and broad (roughly triangular), and prominently set off from shaft, with brachial impression deeply rimming its palmar edge; distal tip of external cotyla bent toward shaft, with short scar running mediad directly beneath, confining small radial impression; distally, large carpal tuberosity jutting abruptly from shaft.

Measurements.-- Greatest length 81.0 mm, breadth across proximal cotylae 9.4 mm, breadth of shaft at middle 4.9 mm, greatest breadth of distal end (through carpal tuberosity) 11.3 mm, depth of distal end through external crest of trochlea 7.5 mm, length of attachment for anterior articular ligament 4.4 mm, breadth of same 4.0 mm.

Etymology.-- The species is named in honor of Pierce Brodkorb in recognition of his many contributions to Paleornithology, including a review of fossil loons.

Discussion.-- The fossil ulna is 25 mm (23.6%) shorter than the minimum for this element in four LACM specimens of the Red-throated Loon, *Gavia stellata* (Pontoppidan, 1763), but is relatively stouter. The proximal radial impression is more confined than in *G. stellata*, *G. pacifica* (Lawrence, 1848), or *G. immer* (Brunnich, 1764). Distally, the carpal tuberosity is more square in outline than in these Recent loons. The short, broad attachment of the anterior

articular ligament, also, is distinct (the attachment is longer and more oval in the Recent species).

A photograph of an ulna of Colymboides minutus Milne-Edwards, 1867 from the Early Miocene of France, illustrated by Storer (1956, fig. 1, g) shows the attachment of the anterior articular ligament to be broad and short. Storer, however, notes that, unlike the ulna of all Recent loons, this element of Colymboides lacks the groove bordering the attachment posteriorly. This groove is present in G. brodkorbi. Furthermore, the carpal tuberosity in Colymboides is less abruptly projected than in G. brodkorbi or in any of the Recent loons.

The only previous Miocene record of the genus Gavia was based on a poorly preserved tibiotarsus from the Calvert Formation, Maryland, cited by Wetmore (1941) as Gavia sp. Four species have been described from the Pliocene: Gavia portisi (Regalia, 1902), Middle Pliocene of Italy; Gavia concinna Wetmore, 1940, Early Pliocene of Florida and Middle and Late Pliocene of California; Gavia palaeodytes Wetmore, 1943, Early Pliocene of Florida; Gavia howardae Brodkorb, 1953, Late Pliocene of California.

According to Brodkorb (1953), who reviewed these species, Gavia portisi is known only from a cervical vertebra that is nearly as large as that of G. immer. The type of G. concinna is an ulna much larger than that of G. brodkorbi (breadth across proximal cotylae 11.6 mm), and is further distinguished by a longer attachment for the anterior articular ligament. G. palaeodytes is known from coracoid, humerus and femur, all equal to, or slightly larger than comparable specimens of G. stellata, hence larger than would be expected for G. brodkorbi.

Gavia howardae was described from an incomplete humerus with two additional humeral specimens referred (all LACM). The smallest referred humerus provides a measurement of length (from distal end to distal tip of deltoid crest) of 91.5 mm, which is 14% less than the minimum for this same measurement in G.

stellata (106.5 mm). The type of G. howardae is incomplete, but appears to have been longer than the referred specimen (possibly within 7 mm of the minimum for G. stellata). Relative breadth is difficult to determine in these incomplete specimens. They appear, however, to be of less stocky proportions than the ulna of G. brodkorbi. Qualitatively there is little on which to base comparison of the humerus of G. howardae with the ulna of G. brodkorbi. However, the long, narrow attachment for the anterior articular ligament on the humerus of G. howardae closely resembles the condition found in G. stellata and is unlikely to correspond with the unusually short, broad attachment for this ligament on the ulna of G. brodkorbi.

Order PROCELLARIIFORMES

Family Diomedidae -- Albatrosses

Genus Diomedea Linnaeus, 1758

Diomedea ?californica Miller, 1962

Fig. 2/ C

Referred material.-- Distal end of tibiotarsus, LACM 37629, from locality LACM 6906.

Discussion.-- Four species of fossil albatrosses have been previously named: D. californica Miller, 1962 and D. milleri Howard, 1966b, from the Middle Miocene of Sharktooth Hill, California; D. thyridata Wilkinson, 1969, from the Late Miocene of Australia; and D. anglica Lydekker, 1891, from the Pliocene of England (type) and Florida (specimen referred by Wetmore, 1943).

D. milleri was described from an ulna with referred tarsometatarsus, both of which are smaller than comparable elements of D. nigripes Audubon, 1839. D. thyridata, described from a rostrum, is likened in characters and size (Wilkinson, 1969) to D. melanophris Temminck, 1828. It would appear, therefore, that both D. milleri and D. thyridata were species whose size range was below that possible for the species represented by the tibiotarsus in the present

collection.

*Figs. 1+2
here*

D. californica and D. anglica, both described from the tarsometatarsus, were larger species than either D. milleri or D. thyridata. The referred specimen of D. anglica is a distal end of tibiotarsus. This specimen (MCZ 2328) was made available for the present study^{plc} (See Fig. 2, B). In distal breadth LACM 37629 from Laguna Niguel is only slightly larger than MCZ 2328. It differs, from the latter, however, in less depression of the supratendinal bridge, and in having a well-developed, papilla-like internal ligamental attachment. In both of these characters LACM 37269 resembles D. exulans Linnaeus, 1758, whereas MCZ 2328 more closely resembles D. albatrus Pallas, 1769, in which the bridge is more depressed and the ligamental attachment is only a scar. Both fossil specimens differ from D. exulans in more horizontal position of the lower opening of the tendinal canal, but in MCZ 2328 the opening is more restricted in lateral extent than in LACM 37629.

Comparison of the Laguna Niguel specimen with D. californica rests entirely on size, as no tibiotarsus assignable to this species has yet been forthcoming from the Sharktooth Hill Bonebed. A second tarsometatarsus (LACM 18203) from that locality is, however, now at hand. This is slightly larger, but otherwise similar to the holotype. The distal breadths in the two tarsometatarsi of D. californica are 92.3% (holotype) and 96.4% (LACM 18203, referred) of this dimension in a tarsometatarsus (LACM B1230) of D. exulans. Compared with the tibiotarsus of the same specimen of D. exulans, the distal breadth of tibiotarsus LACM 37629 from Laguna Niguel is 96.7%^{plc} (See Table I). It appears reasonable, therefore, to assign this specimen to D. californica. However, being unable to compare it with a tibiotarsus from the type locality of D. californica, the assignment is tentative. ✓

*Table I
here*

Diomedea sp. indeterminate

Fig. 2 A, D

Referred material.— Proximal section of humerus, LACM 58544² from locality LACM 6902, and distal end of radius, LACM 31172² from locality LACM 6906.

Discussion.— These poorly preserved wing bones are notably smaller relative to those of D. exulans than is the case with the tarsometatarsi of D. californica or tibiotarsus LACM 37629. They are somewhat smaller, also, than a distal end of humerus from the Sharktooth Hill Bonebed previously referred to D. californica (Howard, 1966b) / (See Table I).

The incomplete humerus lacks the tip of the internal tuberosity, the bicipital crest and a large portion of the deltoid crest. It resembles the humerus of D. exulans in the broad curvature of the anconal face of the shaft, but the area immediately below the head is less depressed. On the palmar surface, the enlarged distal tip of the deltoid crest resembles the condition in D. exulans, but the crest is much shorter in the fossil. The radius is too poorly preserved for analysis, but provides a measurement of distal breadth (see Table I).

Family Procellariidae -- Shearwaters

Genus Puffinus Brisson, 1790

Four wing bones are referable to the genus Puffinus. Thirteen species of Middle to Late Tertiary shearwaters of this genus have been described from Europe and North America, eight of which are from the west coast (see Brodkorb, 1963b, and Howard 1968 and 1971).

After consideration of these species, and careful comparison with specimens of all those from California, I find it necessary to add still another species, which I refer to the subgenus Puffinus.

Puffinus barnesi, new species

Fig. 1 E, F

Holotype.-- Left humerus lacking proximal end, LACM 42652, collected by W. Earl Calhoun, July, 1969, from locality LACM 6906.

Diagnosis.-- ^{Humerus with} Shaft laterally compressed above distal end, but slightly rounded in contour; Internal side of distal end relatively short in anconopalmar dimension, and anconal tip swollen laterally; Impression of brachialis anticus small, and short in proximo-distal dimension; Ectepicondylar process situated relatively near to distal end; Attachment of anterior articular ligament turned slightly laterally rather than facing directly palmar.

Measurements.-- Length from distal end to distal tip of deltoid crest 67.0 mm (estimated total length 80 mm), breadth of distal condyles 7.7 mm, depth of internal side of distal end 8.4 mm, distance from distal surface of condyle to proximal edge of ectepicondylar process 9.5 mm, shaft dimensions near distal end 3.5 mm in breadth, 5.7 mm in depth, shaft dimensions (middle) 3.9 mm in breadth, 5.9 mm in depth.

Etymology.-- The species is named for Lawrence G. Barnes in recognition of his paleontological studies of the marine vertebrates of the west coast.

Discussion.-- The holotype of *P. barnesi* is comparable in general size to the humerus of *Puffinus opisthomelas* Coues, 1864. Although the shaft is compressed laterally as in that Recent species, it is slightly more rounded and less bladelike in the fossil.

With the exception of *Puffinus tedfordi* Howard, 1971, from the Almejas Formation of Cedros Island, Baja California, Mexico, and *P. arvernensis* Milne-Edwards, 1871, from the Early Miocene of France, all previously described Tertiary representatives of this genus are known from the humerus. Shufeldt (1896) referred a humerus to *P. arvernensis*, but according to Stowers Olson (pers. comm.), who has examined the specimen, it comes from a Pleistocene

locality and should be assigned to the Recent species Puffinus puffinus (Brunnich, 1764). The holotypes of both P. tedfordi and P. arvernensis are tarsometatarsi. In both species, this element suggests a stouter bird than is represented by the wing of P. barnesi.

Judging from the descriptions given by Milne-Edwards (1874), the type humeri of his species Puffinus aquitanicus and P. antiquus, from the Middle Miocene of France, both exceed P. barnesi in size. Also, as indicated by a cast of the type of P. donradi Marsh, 1870 (LACM C688), that species was markedly larger than P. barnesi. At the opposite extreme, Brodkorb's (1963a: 161) measurements of the type humerus of his species P. micraulax, from the Hawthorne Formation, Early Miocene of Florida, show that species to be notably smaller than P. barnesi.

Original material or casts of all the California species of Tertiary Puffinus have been examined, including topotypical specimens of humeri referable to P. mitchelli Miller, 1961 (LACM 17500) and P. priscus Miller, 1961 (LACM 17502 and LACM 18140) recovered since the last report on the avifauna of the Middle Miocene of Sharktooth Hill (Howard, 1966b).

Of the California species, the humeri of P. felthami Howard, 1949 (Middle Pliocene of Orange County) and P. mitchelli are larger than P. barnesi. P. inceptor Wetmore, 1930 (Middle Miocene, Sharktooth Hill) agrees in some dimensions, but the marked medial thrust of the internal condyle and the greater anconopalmar dimension of the internal side of the distal end are distinctive characters of P. inceptor. Also, the brachial impression in that species is more distally developed. In P. calhouni Howard, 1968 (Late Miocene, Orange County) and P. priscus the shaft is more compressed and bladelike than in P. barnesi. The ratio of breadth to depth of shaft near the distal end in P. barnesi is 61%, in P. calhouni 50%, and in P. priscus 48-53%.

An excellent relief cast (LACM C692) from the holotype skeletal impression

of P. diatomicus Miller, 1925 (Late Miocene, Lompoc) clearly reveals characters of the palmar aspect of the distal end of the humerus. The impression of the brachialis anticus is more distally extended than in P. barnesi and the ectepicondylar process is placed higher above the distal end (11.6 mm from distal surface of condyle to proximal tip of process).

Most closely approaching P. barnesi in general size are the paratype and referred humeri of P. kanakoffi Howard, 1949 (LACM specimens), from the San Diego Formation. This Pliocene species is distinguished, however, by a longer brachial impression, less rounded shaft (though less compressed than in P. priscus), less inflated anconal tip of the internal condyle, and more palmad-facing attachment for the anterior articular ligament.

Referred material.--- A left ulna, lacking the olecranon (LACM 42654) from the type locality, LACM 6906. Although smaller than would be expected for the wing of the same individual as the holotype, this specimen (like the humerus) falls within the size range of P. opisthomelas (ulnar length, 68.3-76.3 mm), though near the minimum; the holotype humerus is near the maximum size of P. opisthomelas. The few characters discernible in the poorly preserved ulna are: carpal process as in P. opisthomelas, shorter than in a topotype ulna of P. kanakoffi (LACM 2821, previously unreported), and more abruptly projected; external cotyla not prominently projected palmad; ridge present from external cotyla to shaft; attachment for anterior articular ligament seemingly more protruding than in P. opisthomelas, but the area is broken.

Measurements of ulna: Length to intercotylar ridge 70.8 mm, breadth of proximal end 6.5 mm, greatest breadth of distal end 6.4 mm, depth through external crest of trochlea 5.3 mm, shaft dimensions (middle) 3.5 mm x 5.3 mm.

Another poorly preserved fragment of a distal end of an ulna (LACM 52748) from locality LACM 7136, has a distal breadth of approximately 6.3 mm. A wing phalanx (digit 2, phalanx 1), LACM 53925 from locality LACM 3185, measures

20.4 mm in length, which is within the size range of this element of P. opisthomelas. These two specimens are tentatively assigned to P. barnesi.

Family Hydrobatidae -- Storm Petrels

Genus Oceanodroma Reinchenbach, 1852

Oceanodroma sp. indeterminate

Referred material.-- A single incomplete right tarsometatarsus (LACM 42659, from locality LACM 6902) represents this family and genus.

Discussion.-- The specimen resembles this element in O. melania (Bonaparte, 1854), but is slightly longer. The length from distal end to proximal tip of hypotarsus is 31.5 mm. The distal end appears to be narrower than in O. melania, but the preservation is such that accurate measurement is impossible.

The only previously recorded Tertiary storm petrel is O. hubbsi Miller, 1951, from the Capistrano Formation (Late Miocene-Early Pliocene), Orange County, a few miles south of the Laguna Niguel localities. The tarsometatarsus is represented in the type, partial skeleton, of this species preserved in shale. Miller (1951) gives the length of this element as 22.4 mm, markedly less than even the incomplete measurement possible on the specimen now at hand.

Order PELECANIFORMES

Family Pseudodontornithidae -- Bony-toothed Birds

Genus Osteodontornis Howard, 1957

Osteodontornis orri Howard, 1957

Fig. 3 A, D

Referred material.-- Lower Jaw fragment (LACM 22444), and carpometacarpus, (LACM 53906) with portion of proximal end and shaft, both from locality LACM 6902; portion of lower jaw (LACM 42656), with a single "tooth," from locality LACM 7136.

Discussion.-- The jaw fragments resemble previously recorded specimens of Osteodontornis (Howard, 1957a, and Howard and White, 1962), although they seem

somewhat smaller than the type of O. orri.

The fragment of carpometacarpus, however, conforms in size to the left carpometacarpus on the type skeleton, a cast of which is at hand. In fact, the specimen from locality 6902 fits exactly into the impression of the left carpometacarpus on type Slab No. 1 (LACM C703, Block No. 1), in which the large pisiform process has left a deep depression. The present specimen not only clarifies that this depression, was, indeed, made by the pisiform process, but also reveals other characters only suggested in the type, namely, the length of the process of metacarpal 1 and the great compression of metacarpal 3(M3) to metacarpal 2(M2). The very thin M3 is pressed against M2 even distal to the proximal metacarpal symphysis, and the symphysis itself extends almost to the level of the distal tip of the process of M1.

Metacarpal 1 is broken in both the type and LACM 53906, but the area of its attachment to the element as a whole is indicated in the type and clarified in the broken edges of the process on the carpometacarpus from Laguna Niguel.

The length of M1 measured on LACM 53906, is 62.2 mm, approximately one-fourth the total length of the carpometacarpus as seen in the type (252 mm). Enough of the proximal end of LACM 53906 is preserved to obtain an approximate breadth of the proximal trochlea (15.2 mm). The antero-posterior dimension of the trochlea cannot be measured, but it is obvious that the posterior portion is short in distal extent. Shaft breadths of M2 and M3 are 11.0 mm and 4.0 mm respectively. The depth through the compressed M2 and M3 is 16.4 mm. The incomplete specimen measures 126.4 mm from trochlea to broken end of M2.

Except for a prominent pneumatic foramen above the pisiform process, which occurs in most sulids, there is nothing about this highly compressed carpometacarpus to relate it to the Pelecaniformes. I have previously contended (Howard, 1957a) that the bony-toothed birds represent a distinct order, Odontopterigiformes.

Family Sulidae -- Boobies and Gannets

The family Sulidae is the best represented family in the Laguna Niguel collection and the one which has presented the greatest difficulty in identification. Fifteen middle and late Tertiary sulids have been previously described from North America and Europe (see Brodkorb, 1963b:257-261), eight of which are from California (six Miocene, two Pliocene). Five of the species are based on partial skeletons in shale slabs, the others on individual bones involving four different incomplete skeletal elements. A complete review of the known fossils of this family is greatly to be desired. This is a task that some energetic young paleontologist may profitably undertake.

Sixteen bones in the present collection are assignable to at least three species. In spite of the difficulty experienced in correlating the previously described species, I feel justified in describing one new species and in assigning several specimens to one previously described.

Genus Morus Viellot, 1816

Morus lompocanus (Miller, 1925)

Fig. 1 C, D

Referred material.-- Carpometacarpus, LACM 37634; distal end of ulna, LACM 37636, and distal end of femur, LACM 37633; all from locality LACM 6902; carpometacarpus, LACM 77697, from locality 6901; proximal end of tarsometatarsus, LACM 32428, from locality LACM 6906; proximal end of tarsometatarsus, LACM 42657, from locality LACM 7136; distal end of tibiotarsus, LACM 52217, from locality LACM 3185. ✓

Discussion.-- Morus lompocanus was described (Miller, 1925) from the impression of a partial skeleton in a slab of diatomaceous shale from Lompoc, California. Although the holotype (UCMP 26544) was the only specimen described in the text, two other partial skeletons from the same site were so named and illustrated (op. cit.: pl. 7B and pl. 9). These referred specimens (UCMP ¹¹⁷³⁰⁹ ~~2838~~ and UCMP 115855), both bearing Miller's identification, as well as a cast (in relief)

of the holotype (LACM C697) are at hand. On the basis of comparison of size with these specimens, the fossils from Laguna Niguel are referred to M.

lompocanus.

The two carpometacarpi measure 94.7 mm (LACM 37634) and 95.7 mm (LACM 77697) in length. By comparison, a carpometacarpus (LACM Bi 1764) of a female M. bassanus (Linnaeus, 1758) is 90.0 mm, and Miller (1935:78) records another of this Recent species at 94 mm. The referred carpometacarpus of M. lompocanus (UCMP 115855) is 96.6 mm. Other fossil sulids in which this dimension is known are: Palaeosula stockoni (Miller, 1935), 102 mm; Miosula media Miller, 1925, 81 mm; Sula willetti Miller, 1925, 70 mm; S. pohli Howard, 1958, 69 mm; Microsula avita (Wetmore, 1938), 75 mm.

bassanus
83.5 mm
M. process
77.0 mm
M. media
to process

Carpometacarpus LACM 77697, the better preserved of the two Laguna Niguel carpometacarpi (see Fig. 1 C, D), is similar in the shape of the process of M1 to Morus bassanus. But where the small foramina occur in the modern species, there is a deep, slit-like foramen -- one anterior to the pisiform process, and one in a similar position at the base of M1 on the external side of the proximal end. The fossil also resembles Morus in the absence of pneumatic foramina at the posterior edge of the trochlea. Details of qualitative characters are not discernible on the Lompoc specimens.

Ulna LACM 37636 resembles Morus rather than Sula in the pneumaticity of the palmar face of the carpal process, and the size of the process. It is of the same distal breadth (10.5 mm) as the ulna of M. bassanus LACM Bi 1764. Measurements of ulnar breadth cannot be made on M. lompocanus, but the Laguna Niguel specimen corresponds favorably with the impression of the element on Lompoc specimen UCMP 115855.

Femur LACM 37633 conforms in proportions to a raised mold of the element made from the type impression of M. lompocanus. Similar dimensions measured on the two specimens are identical: breadth across anterior face of distal

end 13.9 mm, breadth of shaft 7.0 mm. M. bassanus LACM B1 1764 is larger in these dimensions (14.2 mm and 7.5 mm, respectively).

Tibiotarsus LACM 52217 conforms in size with M. lompocanus specimen UCMP 115855 from Lompoc. The bridge is less vertical in position than in M. bassanus, the upper edge being tipped posteriorly. This is true, as well, of the type tibiotarsus of Miosula recentior Howard, 1949 (LACM 2117) from the Pliocene of San Diego, California. But the latter is distinguished from the specimen now at hand by less vertically oriented condyles. Measurements of LACM 52217 are: breadth of distal end 13.7 mm, depth of distal end 12.4 mm, ratio of depth to breadth 90.5%. The same dimensions in M. bassanus LACM B1 1764 are, breadth 13.0 mm, depth 12.0 mm, ratio depth to breadth 92%.

very like new
M. media
X 1/4 4
M. media 13.0
M. media 13.0

The two proximal ends of tarsometatarsi (LACM 32428 and LACM 42657) measure 12.8 mm and 12.9 mm in proximal breadth, respectively. A mold of the posterior surface of this element on the type specimen of M. lompocanus measures 12.8 mm proximally. The impression visible on Lompoc specimen UCMP 115855 measures 13.5 mm. M. bassanus and a mold of the tarsometatarsus in the type of Miosula media Miller 1925 are broader (14.5 mm and 14.1 mm, respectively).

13.7 on new safety mold
1978

Morus magnus, new species

Fig. 3 B, C; 4 A, B

Holotype.--- Nearly complete left carpometacarpus LACM 37632, collected by Marion J. Bohrer, 1969, from LACM locality 6906.

Diagnosis.--- More than 20% longer than female specimens of this element of Morus bassanus. Area above pisiform process depressed, with small pneumatic orifice. Externally, a deep, slit-like depression at base of process of metacarpal 1.

Measurements.--- Greatest length 116.1 mm, breadth proximal trochlea 11 mm (approximately), breadth of shaft 9.6 mm.

Etymology.-- The species name magnus (Latin, great) refers to the large size of the skeletal elements described.

Discussion.-- Owing to the poor preservation of the holotype carpometacarpus, size is the outstanding distinguishing character. Of previously described sulids, Palaeosula stocktoni most nearly approaches M. magnus in length of this element (102 mm), but is still 13% shorter. Characters of the carpometacarpus other than length are not clearly discernible on the type slab of P. stocktoni (cast, LACM C743). It has been shown, however (Howard, 1958), that at least the humerus of Palaeosula is markedly distinct qualitatively from either Morus or Sula. M. magnus, on the other hand, resembles the living sulids.

From the elements knownⁿ, none of the other Middle^m to Late Tertiary^l fossil sulids gives evidence of approaching M. magnus in size. ✓

Referred material.-- Distal end of humerus, LACM 32430, and shaft of femur, LACM 37628¹ both from the type locality¹ LACM 6906, collected by Bohrer in 1969; ✓ and rostrum, LACM 77696² from locality LACM 6902, collected by Jennifer Whistler, ✓ June, 1975.

The humerus resembles Morus in contract^s to Sula in the absence of the deep pneumatic foramen undercutting the external side of the olecranal fossa. The flat surface of the attachment for the anterior articular ligament, and its length relative to the distal breadth of the element is also similar to Morus. The attachment, however, projects slightly more palmar at its proximal end than in M. bassanus, and, in this respect, resembles Sula. In breadth the element is 22% greater than in M. bassanus. ✓

The fragmentary femur is 18% broader than in M. bassanus in least breadth of shaft, and appears to expand to even greater relative breadth farther distad. It is difficult to be certain of accurately reproducing the same measurement in the two specimens as the distal condyles are lacking in the fossil.

Figs. 3+4
here

Table 2
here

The rostrum resembles Sula in the broad arch of the nasals, but bears resemblance to Morus in the depression of the dorsal contour anterior to the hinge. This depressed area, however, is shorter than in M. bassanus. In greatest breadth, it exceeds the rostrum of M. bassanus by 31% (see Table II).

?Miosula media Miller, 1925

Referred material.-- Tarsometatarsus lacking the proximal end, LACM 32431, from locality LACM 6906.

Discussion.-- This specimen is heavier of shaft than the two proximal fragments of tarsometatarsus referred to Morus lompocanus. In breadth of distal end (17.6 mm) it is slightly larger than an incomplete mold of the tarsometatarsus made from the type skeletal impression of Miosula media (17.3 mm, approx.). Although neither the mold nor LACM 32431 is complete, both suggest a tarsometatarsus that is straighter of shaft than in Morus, but having the slightly raised internal trochlea characteristic of that genus as distinguished from Sula.

Sulidae, spp. indeterminate

Referred material.-- A rostrum, LACM 73565, a proximal end of radius, LACM 58551, and a distal end of tibiotarsus, LACM 57834, all from locality LACM 6902; and a rostrum, LACM 37614, from locality LACM 6906.

Discussion.-- Rostrum LACM 73565 (see Fig. 4 C, D) bears strong resemblance to the cormorants in dorsal aspect, having deep lateral grooves setting off a narrow nasal process. There are, however, no dorsal foramina such as occur in Phalacrocorax. In palatal view, the resemblance is closer to the sulids. The palatines in the maxillo-palatine area are swollen, not flat, and are bordered laterally with wide, deep grooves. Posteriorly the maxillo-palatine area slants smoothly upward and bears very little perforation. In the slope of the area the specimen resembles Morus, in perforation it resembles both Phalacrocorax and Morus, but not Sula. This area in Sula rises more abruptly and is well perforated. The lateral pneumatic openings are much reduced in comparison to

those found in the cormorants, and compare more favorably with those of Morus. Measurements of LACM 73565: ⁹ Greatest breadth 22.2 mm (approximately), greatest depth, 15.1 mm, breadth nasal process 5.2 mm. ✓

In view of the fact that Miller (1925) noted certain characteristics of Miosula media that are cormorant-like, it is possible that this rostrum may represent that species.

The second rostrum (LACM 37614) is typically sulid an all aspects. It is more massive than LACM 73565, but smaller than LACM 77696 referred to Morus magnus. Measurements: greatest breadth 24.0 mm, greatest depth 19.2 mm, breadth nasal process 21.8 mm.

The radius resembles Morus bassanus in general conformation and size, but is poorly preserved. The tibiotarsus is similar in characters of the distal end to LACM 52217 from Laguna Niguel, assigned to Morus lompocanus. The specimen is eroded so that measurements cannot be made precisely. It appears, however, to be narrower but relatively deeper than in LACM 52217, breadth of distal end 12.0 mm (approx.), depth of distal end 11.5 mm (approx.); ratio of depth to breadth 96%.

Order CHARADRIIFORMES

Family Alcidae -- Auklike Birds

Discussion.-- In addition to the six bones of Fraemancalla wetmorei (sub-family Mancallinae) described earlier (Howard, 1976) from localities LACM 6902, 6906 and 3185, the alcids from Laguna Niguel are represented by five fragments assignable to the Alcinae. In view of the fact that comprehensive studies of Tertiary alcids are under way by Storrs Olson at the United States National Museum of Natural History (Atlantic avifauna) and G. Victor Morejohn at California State University, San Jose (Pacific avifauna), I have refrained from attempting to name these poorly preserved specimens.

Five Middle to Late Tertiary alcines have been previously described from ✓

the west coast: Aethia rossmoori Howard, 1968, and Cerorhinca dubia Miller, 1925, from the Late Miocene; Brachyramphus pliocen Howard, 1949, Ptychoramphus tenuis Miller and Bowman, 1958, and Cerorhinca minor, Howard, 1971, from the Middle to Late Pliocene. East coast species are Uria antiqua (Marsh, 1870), and Miocepphus mcclungi Wetmore, 1940, from the Middle Miocene; and Australca grandis Brodkorb, 1955, from the Middle Pliocene. A single species, Uria ausonia Portis, 1887, is recorded from the Middle Pliocene of Italy. (See Brodkorb, 1967, and Howard, 1968 and 1971). There is no indication that any of these species is represented by the material from the Laguna Niguel sites. ✓

Genus Uria Brisson, 1760

?Uria sp

Referred material.-- An incomplete proximal end of humerus, LACM 52018, from locality LACM 6902. ✓

Discussion.-- This poorly preserved specimen resembles the humerus in the murre in the long, oval pectoral scar, and prominent head widening towards the internal side and overhanging a broadly depressed tricipital area between the pectoral scar and the internal tuberosity. Both the deltoid and the bicipital crests are incomplete. That which remains of the bicipital surface is prominently raised proximally and bordered medially below by a deep groove; the bicipital furrow is a deep notch; these characters are most closely matched by humeri of Recent U. lomvia (Linnaeus, 1758). ✓

Comparisons were made with a cast of the type of Uria antiqua, provided through the courtesy of Storrs Olson, United States National Museum of Natural History. Olson (pers. corr.) now refers this species to the genus Australca Brodkorb, 1965. The cast is not only larger, but is much flatter in the bicipital area than in the Laguna Niguel specimen.

Genus Cepphus Pallas, 1769? Cepphus sp.

Referred material.--- A proximal end of ulna with incomplete olecranon, LACM 47045² from locality LACM 6906. ✓

Discussion.--- This specimen resembles the ulna of the Pigeon Guillemot, Cepphus columba Pallas, 1811, in the rounded shaft lacking a distinct keel anconally, and in having the brachial impression bordering the attachment for the anterior articular ligament and extending farther proximally than in most other genera of alcines. However, the brachial impression is broader in the fossil, and more deeply undercuts the attachment for the anterior articular ligament than in the Recent species. Also the attachment for the ligament is more prominent and more square in outline. ✓

The possibility that this specimen might represent the genus Miocepphus prompted me to contact Storrs Olson. He reports (pers. corr.) that "Miocepphus mcclungi is one of the commoner birds in the Calvert Formation of Maryland and Virginia and I have many specimens that have not been reported on in the literature." He provided me with the loan of a complete ulna and humerus which he said "certainly pertain to this species." In the ulna (USNM 237219) the attachment for the anterior articular ligament is less prominent and more elongated than in LACM 47045, the brachial impression is narrower, and the shaft more compressed. LACM 47045 is not related to Miocepphus, which accords with Olson's observation that "Miocepphus is not related to Cepphus" but to the "Alca-Uria group of Atlantic alcids."

Genus Aethia Merrem, 1788? Aethia sp.

Referred material.--- Incomplete humerus, LACM 37686, from locality LACM 6906. ✓

Discussion.--- LACM 37686 is the smallest of the alcine bones from Laguna Niguel. It is possibly related to the Auklet, Aethia rossmoori Howard, 1968,

described from an ulna (LACM 18948) with referred distal end of humerus (LACM 18949), collected in the Monterey Formation at Leisure World in nearby Laguna Hills (locality LACM 1945). LACM 37686 resembles the humerus of A. rossmoori in the rounded shaft, position of the brachial impression with slight rise bordering it externally, and attachment of the anterior articular ligament facing more palmar than laterally. It is, however, 15% larger than the specimen of A. rossmoori. Also, although the area of the tricipital grooves is abraded, the grooves appear to be less deeply incised than in modern species of Aethia, or A. rossmoori.

Tribe Fraterculini

Genus and Species indeterminate

Referred material.-- Proximal end of humerus, LACM 42658, from locality LACM 7136, and distal end of humerus, LACM 37638, from locality LACM 6902.

Discussion.-- Both humeral fragments resemble this element in the puffins (following Storer, 1960:698, in segregating Cerorhinca in a tribe along with Fratercula and Lunda). The proximal portion (LACM 42658) resembles the type humerus of Cerorhinca minor Howard, 1971 (LACM 15408), from the Pliocene of Baja California, Mexico, in the presence of a ridge from the head to the median crest, forming an internal border to the tricipital depression on the anconal surface below the head, and in the extension of the median crest to the border of the bicipital crest. In proximal breadth the Laguna Niguel specimen is 12.0 mm, which is markedly larger than this dimension in C. minor (10.5 mm). It is, in fact, closer in size to a humerus (LACM B1696) of Lunda cirrhata (Pallas, 1769) which measures 12.2 mm in proximal breadth. Similarity to Lunda is seen in the extension of the pectoral attachment to the deepest part of the head, and, on the palmar side, the slight inset of the bicipital surface border from that of the bicipital crest. Similarity to Fratercula corniculata (Naumann, 1821) is noted in the length of the bicipital surface, which becomes

slightly pointed at its distal extreme. The tricipital depression below the head is shallower than in any of the specimens of Recent puffins at hadd.

The distal portion of humerus (LACM 36738) also resembles this element in the Fraterculini. Its size suggests that it may belong to the same species as the proximal end discussed above.

The possibility that these two bones might be assignable to Cerorhinca dubia, described from the Late Miocene of Lompoc, was considered. However, their size seems to preclude this possibility. Miller (1926:116) gave the measurements of length for the type leg bones of C. dubia as 60 mm (tibiotarsus) and 29 mm (tarsometatarsus). These measurements in a series of ten specimens of C. monocerata (Pallas, 1811) are 59.2 mm-60.0 mm, mean 62.9 mm (tibiotarsus), and 27.7 mm-30.6 mm, mean 29.1 mm (tarsometatarsus). The humeri from Laguna Niguel are relatively larger in comparison with the same series of skeletons of C. monocerata: proximal breadth (LACM 42658) 12.0 mm (C. monocerata 6.9 mm-11.3 mm, mean 10.6 mm); distal breadth (LACM 36738) 8.0 mm (C. monocerata 6.9 mm-7.8 mm, mean 7.2 mm).

Genus Praemancalla Howard, 1976

Praemancalla wetmorei Howard, 1976

No further material referable to this species has been found at Laguna Niguel since the type description, which included: holotype humerus, LACM 42653, paratype ulna, LACM 32429, and referred proximal end of humerus, LACM 32432, all from locality LACM 6906; complete radius, LACM 53907, and scapular end of coracoid, LACM 37637, both from locality LACM 6902; and proximal section of carpometacarpus, LACM 52216, from locality LACM 3185.

CONCLUSIONS

Seven families of marine birds are represented by the 39 identifiable avian bones from the Late Miocene deposits in Laguna Niguel. In the following list the numbers in parentheses indicate the number of specimens assigned to each species.

Gaviidae -- Loons

Gavia brodkorbi new sp. (1)

Diomedeidae -- Albatrosses

Diomedea ?californica (1)

Diomedea sp. indet. (2)

Procellariidae -- Shearwaters

Puffinus nigualensis new sp. (4)

Hydrobatidae -- Storm Petrels

Oceanodroma sp. indet. (1)

Pseudodontornithidae -- Extinct Bony-toothed Birds

Osteodontornis orri (3)

Sulidae -- Boobies and Gannets

Morus lompcanus (7)

Morus magnus new sp. (4)

?Miosula media (1)

Sulidae, spp. indet. (4)

Alcidae -- Auklike Birds

?Uria sp. (1)

?Cepphus sp. (1)

?Aethia sp. (1)

Fraterculini, gen. and sp. indet. (2)

Fraemancalla wetmorei (6)

Five of the above families (Diomedidae, Procellariidae, Pseudodontornithidae and Alcidae) are also represented in the larger collection of Late Miocene birds recovered earlier from locality LACM 1945 in Leisure World, Laguna Hills, about three miles north of Laguna Niguel (Howard, 1968). However, few of the same species are listed from the two sites and none of those described as new from locality LACM 1945 is found in the Laguna Niguel area. From locality LACM 1945, 50% of the 120 bones identified are of the Procellariidae (4 species), with Sulidae (3 species) and Alcidae (5 species) constituting approximately 22% each. The remaining 6% include the Anatidae (2 species), Diomedidae (2 species) and ?Osteodontornis orri.

At Laguna Niguel only 10% of the 39 identified bones are procellariid (1 species). The Sulidae are most abundant, making up 41%, followed by the Alcidae 28%. Diomedea and Osteodontornis constituting 7-1/2% each, are relatively better represented than at locality LACM 1945. A loon (Gaviidae) and a storm petrel (Hydrobatidae), not present at LACM 1945, complete the avifauna. The Anatidae are not represented.

Although the deposits at both of these sites are in the Monterey Formation of Late Miocene (Clarendonian correlative) age, comparison of the two avifaunas strengthen the belief suggested by a comparison of the mancalline auks (Howard, 1976) that the fauna from Laguna Niguel represents a slightly later time than that from locality LACM 1945. Not only is the mancalline auk, Praemancalla wetmorei, from Laguna Niguel further specialized for wing-propelled diving than is P. laguensis from locality LACM 1945, but in the Laguna Niguel sites there is less indication of persistence of Middle Miocene species and a more definite representation of typical Late Miocene species. At locality LACM 1945, Presbychen abavus Wetmore, 1930 and Puffinus priscus, both described from the Middle Miocene Sharktooth Hill Bonebed, are listed. Neither has been found at Laguna Niguel, although another species, Diomedea californica, described from

the same locality, is tentatively identified. On the other hand the typically Late Miocene Morus lompocanus, which is only tentatively identified at locality LACM 1945, is the most abundant species at Laguna Niguel. Osteodontornis orri, tentatively listed from LACM 1945, on the basis of a single fragment, is definitely present at Laguna Niguel.

Some significance also may be attached to the occurrence of Gavia and Oceanodroma at Laguna Niguel. This is the first Miocene west coast occurrence of the loons (Gaviidae). The only previous record for Oceanodroma is O. hubbsi Miller in the Capistrano Formation, which is now considered to be of latest Miocene to early Pliocene (Hemphillian correlative) age (Fife, 1974:19) rather than Middle Miocene as interpreted by Miller (1951).

ACKNOWLEDGMENTS

Had it not been for the generosity of the North American Rockwell Land Corporation (NARLAND), this study would not have been possible. Their permission, even encouragement, to collect during their 1969 construction project, and since then, to collect and quarry in adjacent hillsides on NARLAND property, has resulted in amassing the present excellent representation of Late Miocene fossils. I am also grateful to Mrs. Louise Hanson for granting permission to collect on the Moulton Ranch adjacent to NARLAND property.

My thanks are extended to the following people who have contributed fossils for this study: Mr. and Mrs. Marion J. Bohreer and family, Mr. Paul R. Kirkland, Mrs. Janet Price and family, Mr. W. Earl Calhoun, Mr. Rodney Raschke, and Miss Jennifer Whistler.

I am grateful to Dr. Pierce Brodkorb of the University of Florida and Dr. Storrs Olson of the United States National Museum of Natural History, for consultation and for the loan of material for comparison; and to Dr. J. Howard Hutchison, Museum of Paleontology, University of California, Berkeley for the loan of comparative fossil material and permission to cast it. Others who have

contributed comparative material are: Dr. Everett C. Olson, University of California at Los Angeles; Dr. Raymond A. Paynter, Jr., Museum of Comparative Zoology, Harvard University; Dr. Stuart Warter, California State University, Long Beach; and the staff of the Museum of Vertebrate Zoology, University of California, Berkeley.

I am continually indebted to the Natural History Museum of Los Angeles County for the opportunity to work with the Museum's collections, and to the Paleontology staff, in particular, for their cooperation. In the present study, Dr. Lawrence G. Barnes, who was in charge of some of the Museum's excavations at Laguna Niguel, has been a constant source of information and consultation. Others to whom I am grateful for assistance in many ways are: Dr. Theodore Downs, Dr. David Whistler, Robert McKenzie, and Michael Hammer. The photographs were made by Lawrence Reynolds, Museum Photographer. The plates were prepared by Mary Butler, Graphic Artist at LACM.

The curation of this material was made possible under National Science Foundation Grant DEB 7202014, to the Natural History Museum of Los Angeles County Foundation.

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FIGURE LEGENDS

- Figure 1. A, B, Gavia brodkorbi n. sp. holotype ulna, LACM 31173, internal and palmar views. C, D, Morus lompocanus Miller referred carpometacarpus¹ LACM 77697, internal and external views. E, F, Puffinus barnesi n. sp. holotype humerus¹ LACM 42652, palmar and internal views. X 1 ✓
- Figure 2. A and D, Diomedea sp. indet., proximal portion of humerus, LACM 58544, anconal and palmar views. B, Diomedea anglica Lydekker, referred distal end of tibiotarsus from Pierce Florida, MCZ 2328, anterior view. C, Diomedea ?californica Miller, referred distal end of tibiotarsus, LACM 37629, anterior view. X 1
- Figure 3. A and D, Osteodontornis orri Howard, referred proximal half of left carpometacarpus, LACM 53906, posterior and internal views. B, C, Morus magnus n. sp. holotype carpometacarpus, LACM 37632, internal and external views.
- Figure 4. A, B, Morus magnus n. sp., referred rostrum, LACM 77696, ventral and dorsal views. C, D, Sulidae sp. indet., rostrum¹ LACM 73565, dorsal and ventral views. X 1 ✓

TABLE 1

Comparison of Fossil and Recent Specimens of Diomedea

	Measurements in Millimeters				Ratio Fossils to Recent (In Per Cent)		
	<u>D. calif- ornica*</u>	<u>D. sp.**</u>	<u>D. ang- lica***</u>	<u>D. exu- lans****</u>	<u>D. calif- ornica*</u>	<u>D. sp.**</u>	<u>D. ang- lica***</u>
Tarsometatarsus							
Distal breadth	20.6-21.5	.....	19.3	22.3	92.4-96.4	....	86.5
Breadth shaft	9.0-10.0	....	....	9.1	96.8-109.0	....	....
Proximal breadth	....	....	20.7	23.2	....	....	89.1
Tibiotarsus							
Distal breadth	....	20.6	20.2	21.3	....	96.7	94.8
Breadth shaft	....	10.0	9.5	10.0	....	100.0	95.0
Humerus							
Proximal breadth	....	39.2	....	48.5	....	80.8	....
Distance head to end deltoid crest	....	64.5	....	83.7	....	77.0	....
Distal breadth	27.5	....	....	31.6	87.0	....	....
Radius							
Distal breadth	....	11.7	....	14.6	....	80.0	....

* Type and referred specimens from Sharktooth Hill

** Specimens from Laguna Niguel (tibiotarsus referred D. ?californica)

*** Type tarsometatarsus, referred tibiotarsus

**** LACM no. B1230

TABLE 2

Measurements (in millimeters) of Morus magnus and M. bassanus

	<u>M. Magnus</u>	<u>M. bassanus</u> (LACM B1 1764)
<u>Carpometacarpus</u>		
Greatest length	116.1	90.0
Breadth proximal trochlea	11.0 approx.	9.9
Breadth middle of shaft	9.6	7.4
Height process M1	16.0	12.0
<u>Humerus</u>		
Greatest breadth distal end	29.2	24.1
Depth distal end (externally)	17.0	14.4
Breadth of shaft immediately proximal to attachment for anterior articular ligament	22.8	17.0
<u>Femur</u>		
Least breadth shaft	8.9	7.1
Depth of shaft	9.6	7.5
<u>Rostrum</u>		
Breadth at frontonasal hinge	34.8	25.4-26.5*
Greatest depth	25.3	15.4-16.7*
Breadth nasal process	31.4	18.3-19.5*
Length	138.0 (estimate)	101.7-106.5*

* Maximum measurements from rostrum PB 16291, minimum from LACM B1 1765.

Prepared lay-out for figures → Late Miocene Birds from Orange Cr.
Provided Photos, dept. corrects the
size of the prints
~~Holay and Roman~~
4 figures proposed



Photo sizes too large

Figs. A + B should be 81 mm length
(A is now 84.1, B 82.8)

Figs C + D should be 95.7 mm length
(C is now 97.8, D is 98.8 mm)

Figs. E + F should be 67 mm length
E is 68.9 mm, F is 68.0 mm



Fig. 2

Photo Size or for this figure



Fig. 2

Photo Size of for this figure



Photo size OK for Figs. A + D

Figs B + C too large (should be 116.1 mm long)

(Same specimen)

Fig B here measured 118.3 mm

" C " " 120.8 mm



8 mm size for figs. A + D

Figs B + C too large (should be 116.1 mm long)

(Same specimen)

Fig B here measured 118.3 mm

" C " " 120.8 mm

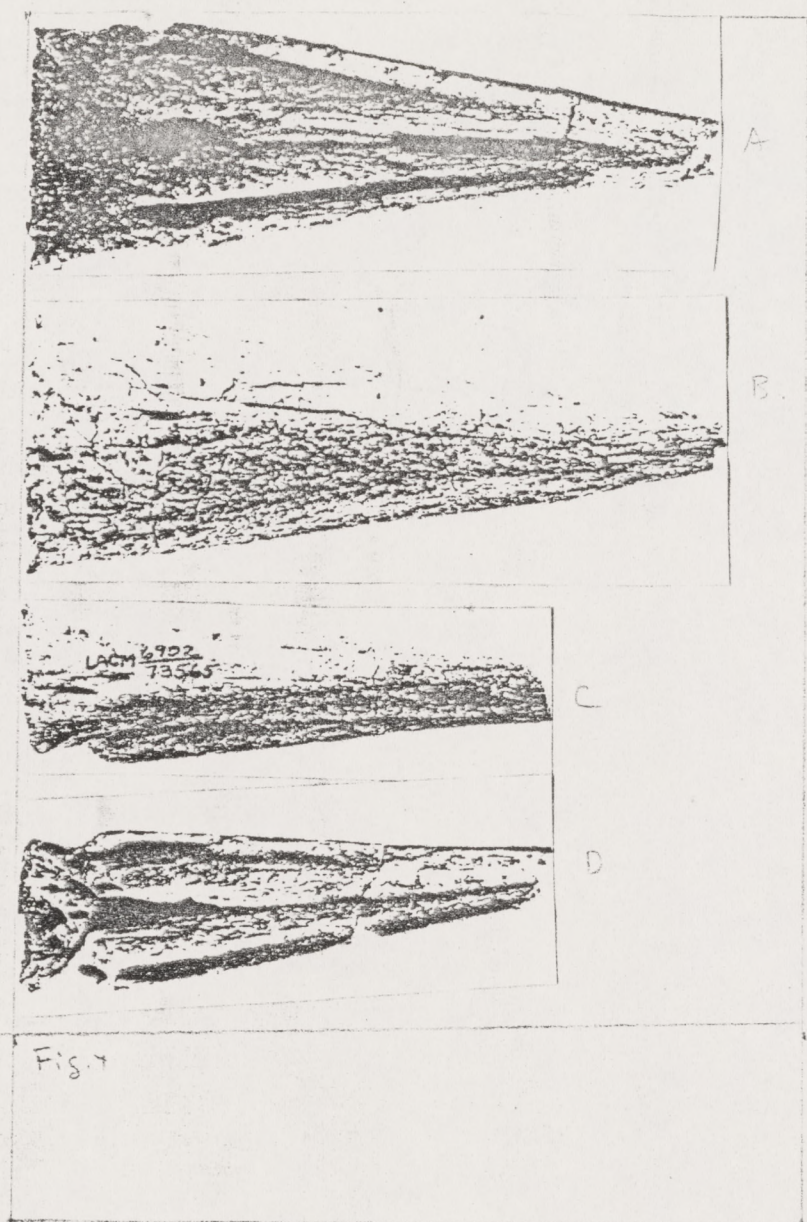


Photo sizes too large Fig. A, B should measure 94.9 in length
 Fig. C, D " " 73.9 " "

(Two negatives involved, A + D on one
 B + C " the other

use this

Legends for figures

- Figure 1. A, B, Gavia brodkorbi n. sp. holotype ulna, LACM 31173, ~~internal~~ and palmar views. C, D, Morus lompocanus Miller referred carpometacarpus LACM 77697, internal and external views. E, F, Puffinus barnesi n. sp. holotype humerus LACM 42652, palmar and internal views. ~~XXXXXXX~~ X 1
- Figure 2. A and D, Diomedea sp. indet., proximal portion of humerus, LACM 58544, anconal and palmar views. B, Diomedea anglica Lydekker, referred distal end of tibiotarsus from Pierce, Florida, MCZ 2328, ^{anterior view} C, Diomedea ?californica Miller, referred distal end of tibiotarsus, LACM 37629, anterior view. X 1.
- Figure 3. A and D, Osteodontornis orri, ^{Howard,} referred proximal half of left carpometacarpus, LACM 53906, posterior and internal views. B, C, Morus ~~xxx~~ magnus n. sp. holotype ~~xxx~~ carpometacarpus, LACM 37632, internal and external views.
- Figure 4. A, B, Morus magnus n. sp., referred rostrum, LACM 77696, ventral and dorsal views. C, D, Sulidae sp. indet., rostrum LACM 73565, dorsal and ventral views.

Figure 1. A, B, Gavia brodkorbi n. sp., holotype ulna, LACM 31173, internal and palmar views; C, D, Morus lompocanus referred carpometacarpus

Legends for figures

List of specimens photographed

- ★ *Morus magnus* n.sp. LACM 37632
 2 holotype carpalometacarpus internal view M (ext. view too big)
 2 referred - rostrum dorsal + ventral views
- omit? *Morus Compoanus*
 2 carpalometacarpus LACM 77697, internal view (or) (ext. view too big)
 1 distal tibiotarsus 52217 (omit?)
- Salicet sp.*
 2 rostrum 73565 dorsal + ventral views
- 1 *Diomedea aegleia* MCZ 2328 (Florida) tibiotarsus aut. view
 1 *Diomedea californica* LACM 37629 aut. view + tibiotarsus
 2 *Diomedea* sp. proximal half humerus ^{LACM} 58544
 coronal + palmar views
- 2 *Osteodromus* *ovis* carpalometacarpus 58906
 posterior + internal views
- ★ 2 *Gavia bradfordi* holotype ulna ^{LACM} 31173, int. + palmar views
 ★ 2 *Puffinus nigricauda* holotype humerus LACM 42652
 external + palmar views

Photos are on 10 negatives will use only 9

Nine specimens illustrated (omitting M. Comp. carpus + tibia) including
 3 types MCZ 2328

list of photographs - recommended plates

Figure 1 A, D. Morus magnus n. sp. referred rostrum ^{LACM} 77696
dorsal (A) and ventral (B) views.
B, C. Gavia Bradburyi n. sp. holotype ulna, LACM 31173
internal (B) and palmar (C) views.
E, H. Sulidae sp. rostrum LACM 73565, dorsal (E) and
ventral (H) views.
F, G. Puffinus nigualeusis n. sp. holotype humerus LACM 42652
palmar (F) and internal (G) views.

Figure 2 A, D. Diomedea sp. indet. incomplete humerus LACM 58544
anconal (A) and palmar (D) views.
B. Diomedea anglica, referred tibiotarsus from Florida
(Wetmore, 1943) MCZ 2328, anterior view.
C. Diomedea ? californica distal end tibiotarsus,
LACM 37629, anterior view.

Figure 3 A, D. Osteodontornis orri referred incomplete carpometa-
carpus, LACM 53906, internal (A) and posterior (D)
views.
B. Morus lompranus referred carpometa-
carpus, LACM 77697, internal view.
C. Morus magnus n. sp. holotype carpometa-
carpus LACM 37632, internal view.

Hildgaard -

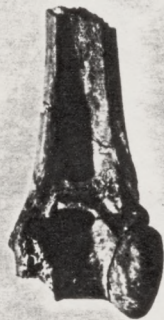
I suggested that the title might convey more information if "Seabirds" or "Marine Birds" were used. Some addition or clarification of measurements and/or sample sizes for the Recent specimens used for comparison would be meaningful (places marked in text).

Also, text references to figures are lacking (although I'm sure you intended to add these after figs. were figured up).

Typographical errors and other minor points are marked in text.

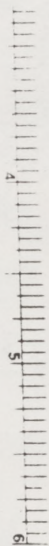
Sorry I took so long getting this to you -

Stu



M. longicauda
5217
C. m. u. s. e. r.

Diomedea ? *californica*
□ 37629



M. longicauda
5227



Peronotus ? californicus
37628

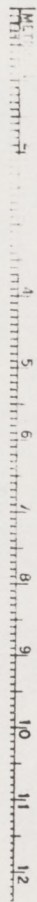


Quarta brachialis
n.sp.

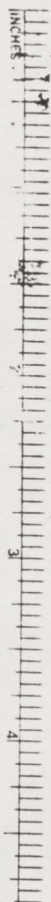


Papilio nigellus
n.sp.

MET.
INCHES



INCHES



Gavia brodkorbi
n. sp.



Puffinus nigricollis
n. sp.



Diomedea anglica
from Florida



Diomedea ? californica

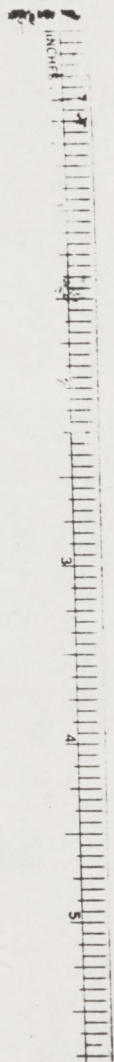




Diomedea sp



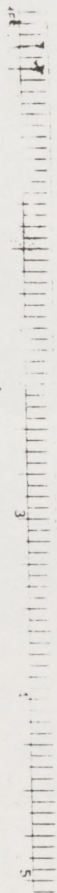
Ostodentornis orri ref. *carpinularis*



Diomedea sp



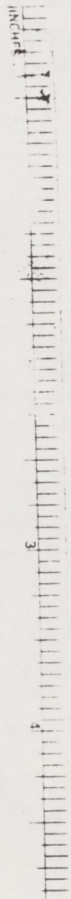
Osteodermis sp. referred
vic. *carpometacarpus*



Sulidae, sp., indet.



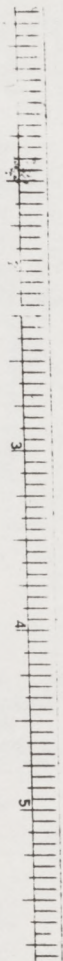
Morus magnus n.sp.
referred rostrum



Sulidae sp. indet.
LACM 73565



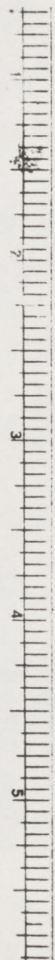
Morus magnus n. sp.
referred rostrum



Momolompraia
refusa



Morus magnus n. sp.



Morus longicauda
referred



Morus magnus n. sp.

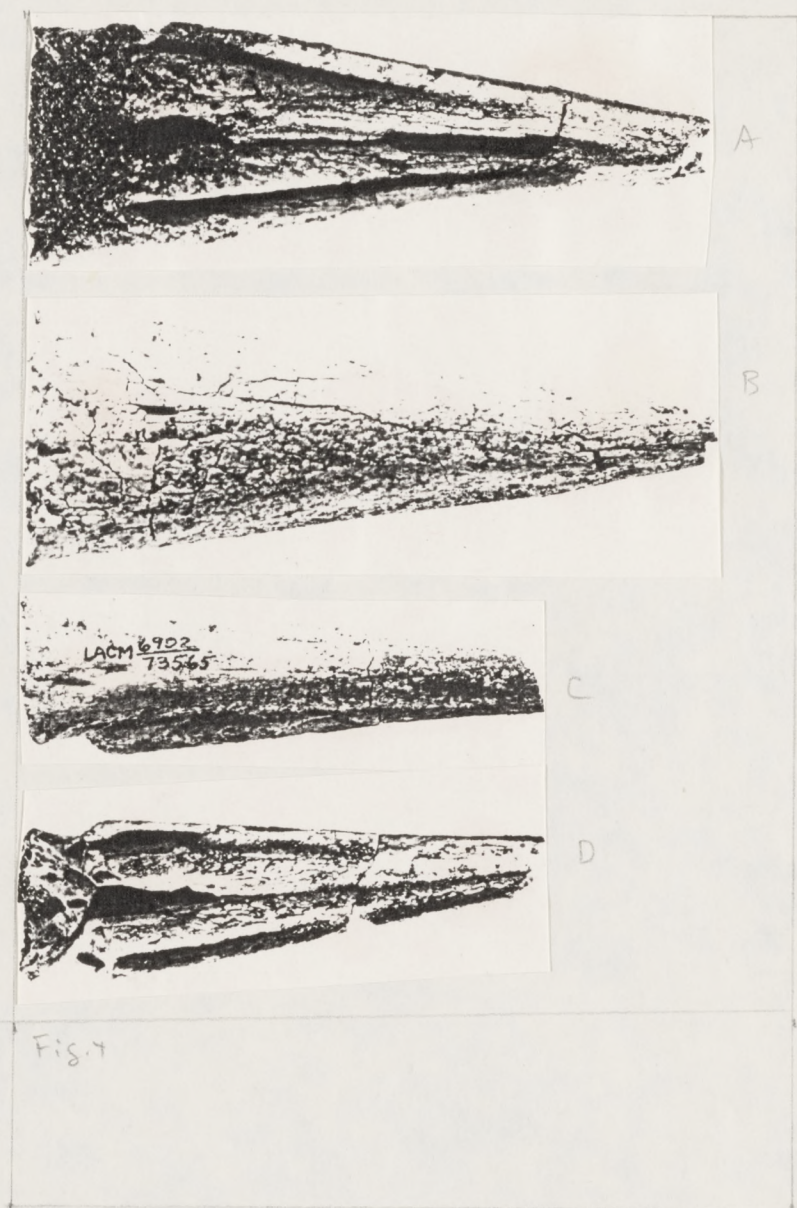


Photo sizes too large
 Figs. A, B should measure 94.9 in length
 Figs. C, D " " 73.9 " "

(Two negatives involved, A + D on one
 B + C " The other

Proposed layout for figures → Late Miocene Birds from Oahu, Co.
 Reprinted Photo by Dept. corrects the
 size of the figures
 4 figures proposed

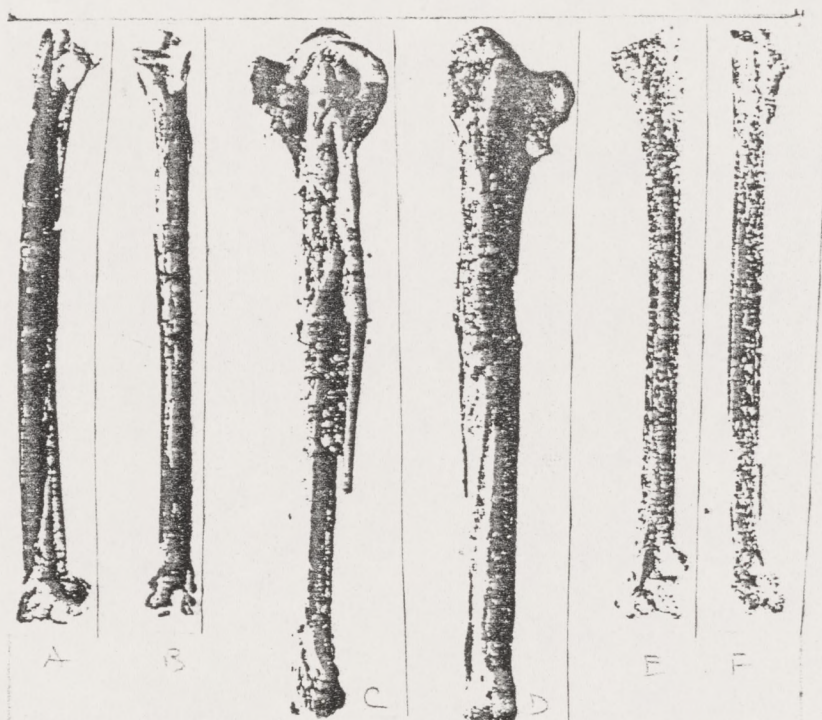


Fig. 1

10 lines or here

Photo sizes too large

Fig. A + B should be 81 mm length
 (A is now 82.1, B 82.2)

Fig. C + D should be 95.7 mm length
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